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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The International Institute of Agriculture was established under the International Treaty of 7 June 1905, which was ratified by forty governments. Eighteen other governments have since adhered to the Institute.

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The Institute, always confining its attention to the international aspect of the various questions concerned, shall:

(*a*) collect, study and publish as promptly as possible, statistical technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets;

(*b*) communicate the above information as soon as possible to those interested;

(*c*) indicate the wages paid for farm work;

(*d*) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and if possible, any effective remedies;

(*e*) study questions concerning agricultural co-operation, insurance and credit from every point of view; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit;

(*f*) submit for the approval of the various governments, if necessary, measures for the protection of the common interests of farmers and for the improvement of their condition, utilizing for this purpose all available sources of information, such as resolutions passed by international or other agricultural congresses and societies, or by scientific and learned bodies, etc.

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The Editor's notes are marked (*Ed.*).

IV. — PERIODICAL PUBLICATIONS REVIEWED BY THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES. *

ARGENTINE.

Agronomia. Buenos Aires.
Anales de la Sociedad rural argentina. Buenos Aires.
Anuario de la Dirección general de Estadistica. Buenos Aires.
Anuario estadistico. República Argentina. Buenos Aires.
Argentine (*The*) *Year-Book*. London.
Boletín de Agricultura. Córdoba.
Boletín mensual del Museo Social Argentino y *Boletín bibliográfico mensual* (*anexo al Bol. mens. d. Museo Soc. Arg.*). Buenos Aires.
Boletín de Obras Públicas de la República Argentina. Buenos Aires.
Boletín de la Sociedad Forestal Argentina. Buenos Aires.
Campo (*El*). Buenos Aires.
Comercio (*El*) *exterior argentino*. Buenos Aires.
Gaceta rural. Buenos Aires.
Ministerio de Agricultura de la Nación. Dirección general de Enseñanza e Investigaciones agrícolas : 1. *Boletín*. — 2. *Circulares*. — 3, *Publicaciones*. Buenos Aires.
Ministerio de Relaciones exteriores y Culto : 1. *Boletín*. — 2. *Circular informativa mensual*. Buenos Aires.
Monitor de Sociedades anónimas y Patentes de Invención. Buenos Aires.
Review (*The*) *of the River Plate*. Buenos Aires.
Revista del Centro Estudiantes de Agronomía y Veterinaria de la Universidad de Buenos Aires. Buenos Aires.
Revista de Ciencias Económicas. Buenos Aires.
Revista Industrial y Agrícola de Tucumán. Tucumán.
Revista de la Facultad de Agronomía y Veterinaria. Buenos Aires.
Revista (*La*) *de la Liga agraria*. Buenos Aires.
Revista Forestal. Buenos Aires.
Revista de la Sociedad rural de Córdoba. Córdoba.
Universidad de Tucumán. Informe del Departamento de Investigaciones industriales. Tucumán.

AUSTRALIA.

Agricultural (*The*) *Gazette of New South Wales*. Sydney.
Agricultural (*The*) *Gazette of Tasmania*. Hobart.
Annual Report. Department of Agriculture and Industries of Western Australia. Perth.
Annual Report. Department of Lands and Survey. South Australia. Adelaide.
Annual Report. Papua. Melbourne.
Annual. Royal Agricultural Society of New South Wales. Sydney.

* A certain number of these publications have not been received regularly during the war. The Library made the necessary arrangements in connection with the renewal of subscriptions and the exchange with the Institute publications. (*Ed.*)

Australian (The) Farm & Home. Melbourne.
Australian Museum. Records. Sydney.
Australian (The) Sugar Journal. Brisbane.
Australian (The) Zoologist. Sydney.
Bulletin of the Department of Agriculture, Western Australia. — Idem: *Division of Botany and Plant Pathology, Entomological Section.* Perth.
Bulletin of the Department of Intelligence, South Australia. Adelaide.
Chemist (The), Druggist and Pharmacist of Australasia. Melbourne.
Dalgety's Review. Sydney.
Fertilizer (The). Sydney.
Fruit (The) World of Australasia. Melbourne.
Government Gazette of Western Australia. Perth.
Institute of Science and Industry. Bulletin. Melbourne.
Journal of the Department of Agriculture of South Australia. Adelaide.
Journal of the Department of Agriculture of Victoria. Melbourne.
Land (The). Sydney.
Motor (The) in Australia. Sydney.
New South Wales. Department of Agriculture: 1. *Farmers' Bulletin.* — 2. *Science Bulletin.* Sydney.
Pastoralist's (The) Review. Melbourne.
Producer's Review. Perth.
Quarterly Summary of Australia Statistics. Melbourne.
Queensland (The) Agricultural Journal. Brisbane.
Queensland. Bureau of Sugar Experiment Stations. Division of Entomology: 1. *Bulletin* — 2. *General Series Bulletin.* Brisbane.
Queensland Government Gazette. Brisbane.
Report. Agricultural and Stock Department. Parliament of Tasmania. Hobart.
Review of Reviews for Australasia. Melbourne.
Science and Industry. Melbourne.
South Australia. Department of Agriculture. Bulletin. Adelaide.
South (The) Australian Government Gazette. Adelaide.
asmania Agricultural and Stock Department. Bulletin. Hobart, Tasmania.
Victorian Year Book. Melbourne.
Western Australia Year Book. Perth.
Year Book (The Official) of New South Wales. Sydney.
Year Book (Official) of the Commonwealth of Australia. Melbourne.

AUSTRIA.

Allgemeine Wein-Zeitung. Wien.
Akademie (Kaiserliche) der Wissenschaften. Sitzungen der math. -naturw. Klasse. Wien.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation. Wien.
Archiv für Chemie und Mikoroskopie. Wien.
Berichte der k. u. k. österr. - ung. Konsularämter. Wien.
Bericht über die Tätigkeit der k. k. landw. - chemischen Versuchsstation und der mit ihr vereinigten k. k. landw. - bakteriologischen und Pflanzenschutzstation in Wien. Wien-Leipzig.
Centralblatt für das gesamte Forstwesen. Wien.
Continentale Holz-Zeitung. Wien.
Deutsch-oesterreichische agrar-Zeitung. Wien.
Handelsmuseum (Das). Wien.
Illustrierte Monatsblätter für Bienenzucht. Wien.
Jahrbuch der k. k. geologischen Reichsanstalt. Wien.
Jahrbuch der k.-k. Landwirtschaftsgesellschaft in Wien. Wien.
Jahrbuch der österreichischen Industrie. Wien.
Jahresbericht der k.-k. Samenkontroll-Station in Wien. Wien.
Jahrbücher der k.-k. zentral-Anstalt für Meteorologie und Geodynamik. Offizielle Publikation. Wien.
Landes-Amtsblatt des Erzherzogtümes Oesterreich u. d. Enns. Wien.
Land- und volkswirtschaftliche Mitteilungen. Linz.
Landwirtschaftliche Mitteilungen für Kärnten. Klagenfurt.
Landwirtschaftliche Zeitshrift. Wien.
Landwirtschaftliche Zeitschrift für Oberoesterreich. Linz.
Milchwirtschaftliche Zeitung. Wien.
Mitteilungen der Fachberichterstatter des k. k. Ackerbauministeriums. Wien.
Mitteilungen des k. k. Ackerbauministeriums über Pferdezucht-Angelegenheiten. Wien.
Mitteilungen der k. k. Gartenbau-Gesellschaft in Steiermark. Graz.
Mitteilungen des Landeskulturrates für Voralberg. Bregenz.
Mitteilungen der landwirtschaftlichen

Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien. Wien.
Mitteilungen des Zuchtvereines für das Alpine Grauvieh in Steiermark. Graz.
Monatshefte für Landwirtschaft. Wien.
Obstzüchter (*Der*). Wien.
Oesterreichische agrar-Zeitung. Wien.
Oesterreichische botanische Zeitschrift. Wien.
Oesterreichische Fischerei-Zeitung. Wien.
Oesterreichische Forst- und Jagdzeitung. Wien.
Oesterreichische Garten-Zeitung. Wien.
Oesterreichische Molkerei-Zeitung. Wien.
Oesterreichische Monatsschrift für den Orient. Wien.
Oesterreichische Moorzeitschrift. Staab.
Oesterreichisch-ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft. Wien.
Oesterreichische Vierteljahresschrift (früher *Monatsschrift*) *für Forstwesen.* Wien.
Pferdezüchter (*Der*). Graz.
Samenkontrollstation (*K. K.*). *Publikationen.* Wien.
Statistisches Jahrbuch des k. k. Ackerbauministeriums. Wien.
Tiroler landwirtschaftliche Blätter. Innsbruck.
Vereinschrift für Forst- Jagd- und Naturkunde. Wien.
Verhandlungen der k. k. geologischen Reichsanstalt. Wien.
Volkswirtschaftliche Chronik der Oesterrechisch-Ungarischen Monarchie. Wien.
Wiener landwirtschaftliche Zeitung. Wien.
Wochenschrift des Zentralvereines für die Rübenzucker-Industrie Österreichs und Ungarns. Wien.
Zitschrift des Österr. Ingenieur u. Architekten-Vereines. Wien.
Zeitschrift für das landwirtschaftliche Versuchswesen in Deutschösterreich. Wien.
Zeitschrift für Moorkultur und Torfverwertung. Wien.
Zentralblatt für das gewerbliche Unterrichtswen in Oesterreich. Wien.

Belgium and Belgian Congo.

Académie royale de Belgique. Bulletin de la Classe des Sciences. Bruxelles.
Agronomie (*L'*) *tropicale.* Uccle-lez-Bruxelles.
Annales de Gembloux. Bruxelles.
Annales de l'Observatoire royal de Bruxelles, publiés aux frais de l'Etat y *Annuaire météorologique.* Bruxelles.
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Storrs: *Storrs Station Bulletin.*
Delaware: Newark: 1. *Bulletin of the Delaware College Agric. Exp. Sta.* — 2. *Annual Report.*
Florida: Gainesville: 1. *Bulletin of the Exp. Sta. of Florida at the State Agricultural College.* — 2. *Annual Report.*
Georgia: Experiment Station: 1. *Bulletin of the Georgia Exp. Sta. State College of Agriculture and Mecha-*

nic Arts. — 2. *Circulars.* — 3. *Annual Report.*

Hawaii: Honolulu: 1. *Bulletin.* — 2. *Extension Bulletin.* — 3. *Press Bulletin.* — 4. *Annual Report.* — *Sugar Planters' Station, Bulletin:* 5. *Agricultural and Chemical Series.* — 6. *Division of Entomology.* — 7. *Division of Patology and Physiology.* — 8. *Special Bulletin, Division of Agriculture and Chemistry.*

Idaho: Moscow: 1. *Bulletin of the Agric. Exp. Sta. University of Idaho.* — 2. *Annual Report.*

Illinois: Urbana: 1. *Bulletin of the Agric. Exp. Sta. University of Illinois.* — 2. *Circulars.* — 3. *Soil Report.* — *Annual Report.*

Springfield: 1. *Illinois Farmers' Institute, Bulletin.* — 2. *Stallion Registration Board, Bulletin.* — 3. *Annual Report.*

Indiana: Lafayette: *Purdue University Agricultural Experiment Station.* 1. *Bulletin.* — 2. *Circulars.* 3. *Annual Report.*

Iowa: Ames: *Agric. Exp. Sta., Iowa State College of Agriculture and Mechanic Arts.* 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Research Bulletin.* — 4. *Annual Report.*

Kansas, Manhattan: *Agric. Exp. Sta. Kansas State Agric. College:* 1. *Farm. Bulletin.* — 2. *Tehcnical Bulletin.* — 3. *Circulars.* — 4. *Inspection Circulars.* — 5. *Annual Report.*

Kentucky: Lexington: *Agric. Exp. Sta. of State University.* — 1. *Bulletin.* — 2. *Annual Report.*

Louisiana: Audubon Park, New Orleans: *Sugar Station Bulletin.*

Baton Rouge: 1. *Bulletin.* — 2. *Annual Report.*

Maine: Orono: 1. *University of Maine, Maine Agric. Exp. Sta., Bulletin.* — 2. *University of Maine, Agricultural Extension Service, Extension Bulletin.* — 3. *Agric. Exp. Sta. Official Inspection.* — 4. *Annual Report.*

Maryland: College Park: 1. *The Maryland State College of Agriculture, Agric. Exp. Sta. Bulletin.* — 2. *Agric. College Quarterly.* — 3. *Annual Report.*

Massachusetts: Amherst: 1. *Bulletin.* — 2. *Bulletin, Control Series.* — 3. *Meteorological Bulletin.* — 4. *Annual Report.*

Michigan: East Lansing: 1. *Bulletin of the Agric. Exp. Sta. Michicagan State Agric. College.* — 2. *Circulars.* — 3. *Special Bulletin.* — 4. *Technical Bulletin.* — 5. *Annual Report.*

Minnesota: St. Paul: 1. *Bulletin of the Agr. Exp. Sta. University of Minnesota.* — 2. *Annual Report.*

Mississippi: Jackson: 1. *Bulletin.* — 2. *Circulars.* — 3. *Annual Report.*

Missouri: Columbia: 1. *Bulletin. of the Agric. Exp. Sta. University of Missouri.* — 2. *Circulars.* — 3. *Research Bulletin.* — 4. *Annual Report.*

Mountain Grave: *Fruit Station Bulletin.*

Montana: Bozeman: 1. *Bulletin of the Agric. Exp. Sta. Montana Agric. College.* — 2. *Circular.* — 3. *Annual Report.*

Nebraska: Lincoln: 1. *The University of Nebraska Bulletin of the Agric. Exp. Sta.* — 2. *Press Bulletin.* — 3. *Annual Report.*

Nevada: Reno: 1. *Bulletin of the Agric. Exp. Sta. University of Nevada.* — 2. *Criculars.* — 3. *Annual Report.*

New Hampshire: Durham: 1. *Bulletin.* — 2. *Scientific Contributions.* — 3. *Annual Report.*

New Jersey: New Brunswick: 1. *Bulletin.* — 2. *Circulars.* — 3. *Special Bulletin.* — 4. *New Jersey State Agricultural College Extension Bulletin.* — 5. *Annual Report.*

New Mexico: Las Cruces: 1. *College of Agriculture and Mechanic Arts Bulletin.* — 2. *Annual Report.*

New York: Geneva: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Bulletin.* — 4. *Annual Report.*

Ithaca: 1. *Home Nature Study Course.* — 2. *Cornell University, College of Agriculture, Agric. Exp. Sta. Bulletin.* — *Cornell Station:* 3. *Circulars;* 4. *Reading-Course for Farmers.* — 5. *Reading-Course for Farmers' Wiwes.* — 6. *The Cornell Reading-Courses Lessons for the Farm Home.* — 7. *New York State College of Agricultxte, Cornell University, Cornell Extension Bulletin.* — 8. *Annual Report.*

North Carolina: Raleigh: 1, *Bulletin.* — 2. *Press Bulletin.* — 3. *Extension Circulars.* — 4. *Annual Report.*

North Dakota: Agricultural College: 1. *Bulletin.* — 2. *Annual Report.*

Ohio: Columbus: 1. *Agricultural College Extension Bulletin.* — 2. *Farmers' Reading Course.* — 3. *Annual Report.*

Wooster: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Series Bulletin.* — 4. *Annual Report.*

Oklahoma: Stillwater: *Oklahoma Agricultural and Mechanical College, Agric. Exp. Sta.:* 1 *Bulletin.* — 2. *Annual Report.*

Oregon: Corwallis: *Oregon Agricultural College and Experiment Station:* 1. *Station Bulletin.* — 2. *Circulars.* — 3. *Division of Horticulture Research Bulletin.* — 4. *Annual Report.*

Pennsylvania: Centre Country: *State Station:* 1. *Bulletin.* — 2. *Annual Report.*

Rhode Island: Kingston: *Agric. Exp. Sta. of the Rhode Island State College:* 1. *Bulletin.* — 2. *Annual Report.*

South Carolina: Clemson College: *South Carolina Agric. Exp. Sta. of Clemson Agric. College:* 1. *Bulletin.* — 2. *Annual Report.*

South Dakota: Brookings: 1. *Bulletin of the Agric. Exp. Sta. South Dakota State's College of Agriculture and Mechanic Arts.* — 2. *Annual Report.*

Tennessee: Knoxville: 1. *Bulletin of the Agric. Exp. Sta. University Tennessee.* — 2. *Annual Report.*

Texas: Austin, College Station: 1. *Bulletin.* — 2. *Press Bulletin.* — 3. *Annual Report.*

Austin: *Press Bulletin.*

Utah: Logan: *Agricultural College Exp. Sta:* 1. *Bulletin.* — 2. — *Circulars.* — 3. *Annual Report.*

Virginia: Norfolk: 1. *Truck Station Bulletin.* — 2. *Annual Report.*

Washington: Pullmann: 1. *Agr. Exp. Sta. Popular Bulletin.* — 2. *State Agricultural College and School of Sciences, Bulletin.* — 3. *Annual Report.*

West Virginia: Morgantown: *Agric. Exp. Sta. West Virginia University:* 1. *Bulletin.* — 2. *Circulars.* 3. *Annual Report.*

Wisconsin: Madison: 1. *Bulletin of the Agric Exp. Sta. University of Wisconsin.* — 2. *Circulars of Information.* — 3. *Research Bulletin.* — 4. *Special Bulletin.* — 5. *Annual Report.*

Wyoming: Laramie: *University of Wyoming Agric. Exp. Sta.:* 1. *Bulletin.* — 2. *Annual Report.*

Agricultural Annual Index. New York.

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American (The) Economic Review. Cambridge, Mass.

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American (The) Fertilizer. Philadelphia.

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Annals of the Missouri Botanical Garden. Saint Louis, Mo.

Asia. Journal of the American Asiatic Association. New York.

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Bureau of Animal Industry: 1. *Bulletin* — 2. *Circulars.* — 3. *Orders.* — 4. *Amendments to Orders.* — 5 *Cattle.* — 6. *Horses.* — 7. *Service and Regulatory Announcements.* — 8. *Publications.*
Bureau of Biological Survey: 1. *Bulletin.* — 2. *Circulars.* — 3. *North*

America Fauna. — 4. *Service and Regulatory Announcements.*

Bureau of Chemistry: 1. *Bulletin.* — 2. *Circulars.* — 3. *Supplements.* — 4. *Service and Regulatory Announcements.*

Bureau of Crop Estimates: *Monthly Corp Reporter.*

Bureau of Entomology: 1. *Bulletin.* — 2. *Circulars.* — 3. *Technical Series Bulletin.*

Bureau of Labor Statistics: *Bulletin. Vocational-Educational Series.*

Bureau of Markets: 1. *Food Surveys.* — 2. *Service and Regulatory Announcements.* — 3. *Seed Reporter.*

Bureau of Plant Industry: 1. *Bulletin* — 2. *Circulars.* — 3. *Crop Physiology and Breeding Investigations Bulletin.* — 4. *Inventory of Seed and Plants Imported by the Office of Foreign Seed and Plant Introduction.* — 5. *Office of Foreign Seed and Plant Introduction Bulletin.* — 6. *Publicacations B. P. I.* — 7. *Service and Regulatory Announcements.* — 8. *Western Irrigation Agriculture.*

Bureau of Soils: 1. *Bulletin.*— 2. *Advance Sheets. Field Operations of the Bureau of Soils.* — 3. *Circulars.*

Bureau of Soils and Bureau of Plant Industry Cooperating: *Report.*

Bureau of Standards: *Bulletin.*

Bureau of Statistics: 1. *Bulletin.* — 2. *Circulars.*

Division of Publications: 1. *Circulars.* — 2. *Monthly List of Publications.* — 3. *Library Bulletin.*

Federated Horticultural Board: *Service and Regulatory Announcements.*

Forest Service: 1. *Bulletin.* — 2. *Circulars.* — 3. *Sylvical Leaflets.*

Insecticide and Fungicide Board: *Service and Regulatory Announcements.*

Office of Experiment Stations: 1. *Bulletin.* — 2. *Bulletin of Experiment Station Work.* — 3. *Circulars.* — 4. *Farmers' Intitute Lecture.* — 5. *Publications.*

Office of Markets and Rural Organization: *Service and Regulatory Announcements.*

Office of Public Roads: 1. *Bulletin.* — 2. *Circulars.*

Office of the Secretary: 1. *Circulars.* — 2. *Food Inspection Decision, Publications.* — 3. *Insecticide Decision, Circulars.* — 4. *Notices of Judgement.* — 5. *Publications.* — 6. *Report.*

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States Relations Service: 1 *Department Circulars.* — 2. *List of Station Publications received by the Office of Exper. Sta.*

Wheather Bureau: 1. *Climatological Data for the U. S. by Sections.* — 2. *Publications.* — 3. *Monthly Weather Review.* — 4. *National Weather and Crop Bulletin.*

United States Department of Commerce and Labor. Washington.

Bureau of Fisheries: *Documents.*

Bureau of Foreign and Domestic Commerce: 1. *Commerce Reports. Daily Consular and Trade Reports.* — 2. *Supplements (Consular Reports).* 3. *Monthly Summary of the Foreign Commerce of the United States.*

United States Department of Interior. Washington.

Bureau of Mines: 1. *Bulletin.* — 2. *Miners' Circulars.* — 3. *Technical Paper.* — 4. *Annual Report by the Director of the Bureau of Mines to the Secretary of Interior.*

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U. S. Geological Survey: 1. *Bulletin.* — 2. *Water Supply Paper.*

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Campaña (*La*). Montevideo.
Comisión central de Defensa agrícola. Publicaciones. Montevideo.
División de Agricultura. Estudios sobre cultivos y Trabajos experimentales de la División de Agricultura. Montevideo.
Estanciero (*El*). Montevideo.
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Propaganda (*La*). *Correo del Sábado.* Montevideo.
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Propiedad (*La*) *territorial.* Montevideo.
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Revista de la Federación rural. Montevideo.
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Revista del Centro Ganadero. Montevideo.
Revista del Instituto nacional de Agronomía. Montevideo.
Revista del Ministerio de Industrias. Montevideo.
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VENEZUELA.

Boletín del Ministerio de Fomento. Caracas.

V. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	=	27.99961	inches
1 Ardeb (Egypt)	=	5.44435	bushels
1 Ardeb of wheat (Egypt)	=	2.95264	cwt.
1 Ardeb of hulled maize (Egypt)	=	2.75580	cwt.
1 Ardeb of barley (Egypt)	=	2.36211	cwt.
1 Ardeb of undecorticated rice (Egypt)	=	5.72812	cwt.
1 Ardeb of decorticated rice (Egypt)	=	3.83813	cwt.
1 Arpent (Canada)	=	0.84501	acre
1 Are [100 square metres]	=	107.63915	square feet
1 Arroba (Brazil)	=	33.06951	lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841	lbs.
1 Arroba (Mexico)	=	25.36687	lbs.
1 Bale of cotton (Brazil)	=	396.83415	lbs.
1 Bale of cotton (United States)	=	4.46431	cwt. (gross wt.)
1 » » » » »	=	4.26788	cwt. (net wt.)
1 Bale of cotton (India)	=	3.57145	cwt.
1 Barrel of wheat flour (Canada, United States)	=	1.75001	cwt.
1 Bar, see Millier			
1 Bow (Java, Dutch Indies)	=	76.36998	square feet
1 Bushel (United States)	=	0.96896	bushels
1 Bushel of oats (United States)	=	32	lbs.
1 Bushel of oats (Canada)	=	34	lbs.
1 Bushel of wheat and potatoes (United States)	=	60	lbs.
1 Bushel of barley (Canada, United States)	=	48	lbs.
1 Bushel of raw rice (United States)	=	45	lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	=	56	lbs.
1 Cadastral arpent (Hungary)	=	1.42201	acres
1 Cental (United States)	=	100	lbs.
1 Centiare [10 square metres]	=	10.76392	square feet
1 Centigramme	=	0.15432	grains
1 Centilitre	=	0.0022	gallons
1 Centimetre	=	0.393715	inches
1 Centistere	=	0.35315	cubic feet
1 Centner (Germany, Austria, Denmark)	=	110.23171	lbs.
1 Centner (Sweden)	=	93.71238	lbs.
1 Cho [60 ken] (Japan)	=	119.30327	yards.
1 Cho (Japan)	=	2.45068	acres
1 Crown [100 heller] (Austria-Hungary)	=	10 *d*	at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	=	1s 1 1/8 *d*	at par
1 Cubic centimetre	=	0.06102	cubic inch
1 Cubic metre	=	1.30795	cubic yards
1 Decagramme [10 grammes]	=	0.35275	oz.

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	=	0.022 gallons
	=	0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 $^{93}/_{64}$ *d* at par
1 Dollar, gold, $ [100 cents] (United States)	=	4 *s* 1 $^{5}/_{10}$ *d* at par
1 Drachm, gold [100 lepta] (Greece)	=	9 $^{33}/_{64}$ *d* at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 *s* 7 $^{53}/_{64}$ *d* at par
1 Franc [100 centimes] (France)	=	9 $^{33}/_{64}$ *d* at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
1 Hectolitre [100 litres]	=	21.99755 gallons
	=	2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 $^{3}/_{200}$ farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 $^{33}/_{64}$ *d* at par
1 Leu [100 statinki] (Bulgaria)	=	9 $^{33}/_{64}$ *d* at par
1 Lira [100 centesimi] (Italy)	=	9 $^{33}/_{64}$ *d* at par
1 Litre	=	0.21998 gallons
	=	0.0275 bushels
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 $^{3}/_{4}$ *d* at par
1 Mark [100 penni] (Finland)	=	9 $^{38}/_{64}$ *d* at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	=	2 199.75539 gallons
	=	274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2 *s* 2 $^{61}/_{64}$ *d* at par
1 Milreis, gold (Portugal)	=	4 *s* 5 $^{19}/_{64}$ *d* at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Cape of good Hope)	=	2.11654 acres
1 Muid (Cape of good Hope)	=	24 gallons
	=	3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 $^{33}/_{64}$ *d* at par
1 Peso, gold [100 centavos] (Argentina)	=	3 *s* 11 $^{37}/_{64}$ *d* at par
1 Peso, gold [100 centavos] (Chili)	=	1 *s* 5 $^{63}/_{64}$ *d* at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1. 0. 6 $^{43}/_{64}$ at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18 *s* 0 $^{51}/_{64}$ *d* at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2 *s* 1 $^{3}/_{8}$ *d* at par
1 Rupee, silver [16 annas] (British India)	=	1 *s* 4 *d* at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1 *s* 11 $^{51}/_{64}$ *d* at par
1 Talari [20 piastres] (Egypt	=	4 *s* 1 $^{11}/_{32}$ *d* at par
1 To (Japan)	=	0.49601 bushels
	=	3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2 *s* 0 $^{37}/_{64}$ *d* at par
1 Zentner (Germany)	=	110.23171 lbs.

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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

RURAL HYGIENE

1 – **Antagonism of Livestock and Man in the Blood Nutrition of *Anopheles maculipennis*. The Antimalarial Role of Domestic Cattle.** — ROUBAUD, E. in *Comptes rendus de l'Académie des Sciences*, Vol 169, No. 10, pp. 483-486. Paris, Sept. 8, 1919.

It is generally thought that anopheles seek nourishment not only from the blood of human beings but also from that of animals. Certain species of anopheles are found in uninhabited regions, peopled only by big game.

The *Anopheles maculipennis*, chief carrier of malaria in Europe, frequents mostly cow-sheds and stables. From observations made by the author, principally in the Vendée marshes, the Lower Loire and the neighbourhood of Paris, the following facts were ascertained : —

1. The *Anopheles maculipennis* bite in the interior of places occupied by man or domestic animals. It seeks first animals, exceptionally man.

2. The anopheles share each night, in order of preferance, the available animals of a district. The animals most sought after protect the others. In order of preference, mosquitoes seek in the first place pigs, then cattle, horses, goats, sheep and lastly rabbits and dogs ; poultry are only bitten exceptionally.

3. Man is protected by animals. The more easily the anopheles are able to satisfy their need of blood on livestock the more that protection is complete. The presence or absence of anopheles in houses is regulated in this manner.

[Abstract No. 1]

4. It is not so much the greater or less abundance of blood nourishment which regulates the relative density of the anopheles fauna as the extent and suitability of the places where their larvae develop.

It may, therefore, be concluded that in the countries of Europe where mosquitoes are not too numerous, domestic animals play an antimalarial role of the first order, by attracting to them the great majority of the anopheles. Far from exercising, as might be supposed, a prejudicial action by contributing to the maintenance of the anopheles of a locality, they divert and separate dangerous relations which, in their absence, would certainly be established between these anopheles and man (1).

It is in this way also that the progress of agriculture improves hygiene in pastoral countries. It seems that antimalarial prophylaxis may derive real benefit from these recorded facts.

2 - **Scientific Food Problems in France during the War.** — *Comptes des rendus Séances de la Commission d'Alimentation de la Société de Biologie*, pp. 160, Paris, 1919.

The « Comptes rendus des Séances de la Commission d'Alimentation de la Société de Biologie » from the May 25, 1918 to the March, 1919, meetings held under the presidency of Prof. Charles RICHET, summarised by M. R. LEGENDRE, Secretary of the Commission, are collected in one volume.

Numerous questions have been dealt with in the course of these meetings, particularly by the inter-allied scientific Food Commission at Rome. Among others, have been dealt with the questions of flours, their degree of bolting and their preparation for making war bread, of food supplies, of the requirements of the body for fats (the experimental data are insufficient to establish the need of a minimum of fats; it appears, however, that the ration should contain a certain amount of fat but the quantity cannot be fixed; fats of vegetable origin are as digestible as animal fats; there is reason to recommend their use which is economically less costly), of milk, of cattle, of requirements in nitrogenous matter, etc. The report of the inter-allied scientific Commission relating to the influence of anthropometric and climatic factors on the food requirements of the Allies, prepared by Prof. E. H. STARLING, is also given.

The volume reviewed includes a second part (pp. 65-159) which is an analytical bibliography of French works published during the war (1914-1918) on food questions and alimentary hygiene. Some of these works have already been dealt with in this *Review* (2).

3 - **Influence of High Temperatures and Dilute Alkalis on the Antineuritic Properties of Foods.** — DANIELS, A. L., and MCCLURG, N. I. in *The Journl of Biological Chemistry*, Vol. XXXVII, No. 1, pp. 201-213, 5 diagr. Baltimore, Jan., 1919.

The authors have studied the effect, on the antineuritic properties of

(1) All animals bitten by anopheles are absolutely resistant to malaria, consequently the mosquito which bites them cannot draw from their blood the organism of malaria and transmit it to man. (*Ed.*)

(2) These questions were dealt with in the *Review* in the course of their development. See *R.* Nov. 1917, No. 1700; Jan. 1918, No. 3; Feb. 1918, No. 216; March 1918, No. 343 and 344; April 1918, No. 379. See also *R.* July-Sept. 1919, No. 812. (*Ed.*)

cabbage, soya beans and haricot beans, of cooking: (1) in boiling spring water; (2) in boiling water to which a small quantity of bicarbonate of soda was added; (3) in an autoclave at 120° C. fo 115 minutes. Admitting that the water-soluble vitamine is more liable to be decomposed by external agents than substances not soluble in hot water, the food value of substances extracted by water used in cooking was tested on young rats; these substances were fed abundantly in rations otherwise complete. The growth curves obtained indicate that there was in no case appreciable destruction of the water-soluble vitamine.

The results obtained by the authors for the water-soluble vitamine treated with dilute alkali do not agree with the results obtained by McCollum and Simmonds (*Journal of Biological Chemistry*, Vol. XXXIII, No. 1, p. 55, 1918). These two writers had reported cessation of growth in rats fed with vitamine soluble in water, to which alkali was added, boiled for one hour. It is, however, probable that their rations contained a very small quantity of antineuritic vitamine, derived from 10 % of wheat embryo, while the rations used by the authors contained a much larger amount of vitamine; this explains why the slight destruction indicated by failure to grow in the experiments of McCollum and Simmonds did not appear in the experiments carried out by the authors.

The results obtained by heating foods to 120° C. do not agree with those reported by Chick and Hume (*Proceedings of the Royal Society*, Series B, Vol. XL, p. 60, 1917-1918) according to which the use of large amounts of preserved foods may cause serious danger.

The authors think that this conclusion is unfounded at least from the standpoint of the antineuritic vitamine content of the foods. In agreement on this point with McCollum and his co-workers, they think it is improbable that, during the commercial preparation of tinned foods, the vitamine can be destroyed to such an extent as to be deficient in the ration where the usual amount of tinned food is eaten.

4 - **Action of Ultra-Violets Rays on Vitamines** (1). — Zilva, S. S., in *Biochemical Journal*, Vol. XIII, No. 2, pp. 164-171. Cambridge, July, 1919.

The fat-soluble A factor in butter fat is destroyed by an 8 hours' exposure to ultra-violet rays; at the same time the butter is bleached and becomes unfit for consumption. The author therefore asks whether the sterilisation ofmilk by the ultra-violet rays can decrease its nutritive value?

The antineuritic and antiscorbutic vitamines are not destroyed by ultra-violet rays; in fact, the author has reported that the exposure of neutralised lemon juice for 8 hours to ultra-violet rays did not influence its antiscorbutic activity, and that a similar exposure of autolysed yeast juice did not impair its antineuritic power.

5 - **Hygienic and Food Value of Carrots and Tomatoes.** — I. Sugiura, K. A., Preliminary report on the preparation of antipolyneuritic substances from carrots and yeast, in *The Journal of Biological Chemistry*, Vol. XXXVI, No. 1, pp. 191-196. Baltimore, Oct., 1918. — II. Denton, M. C. and Kohman, E., Feeding experiments with raw

(1) See *R.*, July-Sept., 1919, No. 1000. (*Ed.*)

and boiled carrots, *Ibidem*, Vol. XXVI, No. 2, pp. 249-263, 2 diagr., Nov., 1918. — III. GIVENS, M. H. and MCCLUGAGE, H. B., The antiscorbutic property of vegetables, an experimental study of raw and dried tomatoes, in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 2, pp. 253-269, 6 diagr. Baltimore, Feb., 1919.

I. — PREPARATION OF ANTIPOLYNEURITIC SUBSTANCES FROM CARROTS AND YEAST (1). — Natural curative substances for the treatment of polyneuritis induced in pigeons and other fowls by a diet of polished rice have been prepared from residues of rice polishing, autolysed yeast, animal tissues, cabbage, and potato juices, and the yolk of egg. During the last 10 years many scientists have endeavoured to isolate these curative substances so as to establish their chemical nature. During the last 3 years artificial antipolyneuritic substances have been prepared and discussed by FUNK, WILLIAMS, WILLIAMS & SEIDELL, but VOEGTLIN & WHITE, STEENBOCK and HARDEN & ZILVA have not confirmed their results. In a preceding paper (*Journal of Biological Chemistry*, Vol. XXXVI, p. 171, 1918), the author has shown that both water and alcoholic extracts of fresh carrots contain growth-promoting substances. Further, he noted that his yeast preparations had the power of growth-promoting equally with the carrot extracts.

By means of experiments described in the paper reviewed, the author has proved that extracts of fresh carrots and crystalline substances extracted from yeast preparations (brewers' yeast filtered, pressed, dried in the air and ground; the powder so obtained was suspended in water and dialysed; the crystals form on the outer wall of the dialysing membrane) can cure polyneuritis in pigeons, in those cases in which the disease has developed rapidly, namely, in about 20 days; but they did not prevent death in cases in which the symptoms developed slowly, and in which the birds had not only lost the power of muscular movement, but were also emaciated.

I. — ALIMENTARY VALUE OF RAW AND COOKED CARROTS. — This has been ascertained by means of experiments on white rats. The results were as follows: —

Ordinary methods of cooking do not perceptibly diminish the nutritive value of carrots, at least when they form part of a mixed diet. But a considerable portion of the calorie value of the food is lost if the water used in cooking is rejected (2), as, indeed, is generally the case with food consumed by animals when the water used in cooking is not added.

Carrots, with a suitable supplement of starch, purified commercial casein, butter or lard, and salt, so that 50 % of the calories are still derived from the carrots, will produce normal growth and reproduction in white rats.

Carrots as an exclusive diet, except for the addition of calcium, phosphorus, sodium, and chlorine, can maintain animals in good health, as far as can be judged from their appearance, for as long as 16 weeks. Although there is no growth, the animals on this diet maintain their live weight and sometimes even increase it. Owing to the great variation in the nutritive

(1) See *R.*, Feb. 1918, No. 125.

(2) See *R.*, May 1919, No. 554. (*Ed.*)

value of carrots and in the vitality of different animals, the results of this diet are somewhat inconstant.

Carrots contain considerable quantities of water-soluble and fat-soluble vitamine.

When, in a carrot diet, the proportion of nitrogen was diminished by the addition of some non-nitrogenous food, such as fat or starch, a great number of the rats were attacked by dropsy (1).

III. ANTISCORBUTIC PROPERTIES OF RAW AND DRIED TOMATOES (2). — HOLST and FRÖLICH (*Zeitschrift für Hygiene*, Vol LXXII, p. 1, 1912; Vol. LXXV, p. 334, 1913) and CHICK & HUME (*Transactions of the Society of Tropical Medicine and Hygiene*, Vol. X, p. 141) found that dried vegetables were more or less deficient in the antiscorbutic property. CHICK, HUME and SKELTON (*Biochemical Journal*, Vol. XII, p. 131, 1918) have recently reported that the feeble antiscorbutic property of fresh milk is destroyed by drying or by being kept for a long time after drying. HESS and HUNGER (*Journal of Biological Chemistry*, Vol. XXXV, pp. 479-487, 1918) have stated that dried vegetables have little or no antiscorbutic virtue. STEFÁNSSON (*Journal of American Medical Association*, Vol. LXXI, p. 1715, 1918), alleges that the strongest antiscorbutic qualities reside in certain fresh foods and diminish or disappear with storage by any of the common methods of preservation, i. e., in tins, with vinegar, with oil — etc., drying etc. GIVENS and COHEN (*Journal of Biological Chemistry*, Vol. XXXVI, p. 127, 1918), experimenting with the influence of temperature on the vitamine in the drying of cabbage have concluded that the degree of temperature during that operation is the factor which determines the presence or absence of the accessory antiscorbutic substance.

The authors have experimented with the influence of temperature on the antiscorbutic properties of the tomato and have drawn the following conclusions : —

Fresh tomato is an efficient antiscorbutic agent. A small daily addition of raw tomato (1 gm.) to a diet known to cause scurvy in guinea pigs, preserved these animals in a perfect state of health, as far as could be judged.

Raw tomatoes dried in a blast of air either at a low temperature (35°-40° C.) or a high temperature (55°-60° C.) retain a noticeable amount of their antiscorbutic potency. It is possible that the drying at either temperature may destroy some of the antiscorbutic vitamine, but to what degree has not yet been ascertained. These experiments confirm the results of CHICK, HUME, and SKELTON, who believe that scurvy is due to the deficiency, in the diet, of a specific accessory substance, and they corroborate

(1) The Committee for the control of foodstuffs attached to the office of the Food Controller in the United Kingdom drew the attention of the public, during the war, to the high food value of carrots : it pointed out that 3 lb. of carrots were equivalent to 2 lb. of potatoes — 1 lb. of veal or chicken — 1 lb. of bread — 6 lb. of tomatoes — 7 or 8 eggs. — *Bollettino dei consumi, pubblicazione del Ministero degli Approvvigionamenti e dei Consumi alimentari*, No. 56-57, p. 15. Rome, Apr. 21-28, 1918.

(2) See *R.*, Dec., 1918, No. 1322. (*Ed.*)

the contention of COHEN and MENDEL that roughage, in as much as it affects the structure of the diet, is not the determining factor.

6 – **Destruction of Bed Bugs (*Cimex lectularius* Mor.) by Chloropicrin.** — BERTRAND, G., BROCQ-ROUSSEY and DASSONVILLE, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXIX, No. 9, pp. 441-443. Paris, Sept 1, 1919.

The problem of the destruction of bugs is of very great importance because of the present necessity of disinfecting military barracks and numerous civil buildings.

The authors have experimented with chloropicrin and their trials have enabled them to determine that the destruction of bugs can be effected with such small doses of that substance that its use is practical. Doses of 4 to 10 grammes per cubic metre appear to be most suitable (the bugs are then killed in from 1-2 ½ hours). In case the eggs are not destroyed, the hatching period being about 8 days, a fresh disinfection should be made about 2 weeks after the first to insure the destruction of the new generations.

The powdering of the chloropicrin in the premises and entry into them is facilitated by the use of one of the anti-gas masks used during the war, such as the A. R. S. mask.

RICULTURAL HOWS AND ONGRESSES

7 – **The Fair of Hanoi.** — *Bulletin économique de l'Indochine*, New Ser., Year XXII, No. 136, pp 289-364, 6 phot. Hanoï-Haïphong, May-June, 1919.

A detailed report of Hanoï Fair in 1918 which, after the example of the celebrated fairs at Nijni-Novgorod, Leipzig, Lyons, Bordeaux, etc. was instituted with the object of making known the products of the country (in this case of the whole of Indo-China), to take stock, to a certain extent, of its wealth, the schedule of its productive faculties, in order to be able with certainty to induce supply and satisfy demand, to develop the production of the colony, the expansion of French industry and commerce.

But the Hanoï fair could not rival a sample fair at Lyons (because of its still rudimentary industry and of the commercial mentality of the natives, etc.) and it was a real market of Indo-China. In the eyes of the committee of the fair, if imports were interesting, exports had a considerable importance for the future of the Colony, and this fair was like the basis of a catalogue (the original article contains the complete list of the exhibitors and of the products exhibited) of local wealth, like a detailed memorandum of all that Indo-China could furnish and manufacture. The success of this exhibition has surpassed all expectations.

CROPS AND CULTIVATION

ICULTURAL TEOROLOGY

8 – **The Importance of Agricultural Meteorology in Tropical Countries.** — MC LEAN, F. T., in *The Philippine Agriculturist*, Vol. VII, No. 7, pp. 191-194. Los Baños, Feb., 1919.

It is not only in temperate regions that agricultural meteorology attracts increasingly the attention of farmers, they are also interested in it in tropical countries, where the dominating influence of the position of

the sun and its effect on wind, cloud and rainfall make changes in weather much more regular and facilitates considerably the adaptation of cultivation to the climate. Thus, for example, in the Philippine islands the periods of sunshine and the amount of rainfall are in close connection with the north-east trade wind which blows steadily from November to April and the south west monsoon between May and September. Local topographical conditions (proximity of large stretches of water and high mountain ranges) influence the effects of the winds in a constant and well defined manner, and enable the frequency and distribution of meteorological phenomena to be calculated with satisfactory approximation. Even typhoons, apparently so erratic, have periods of greater or less frequency annually and the precise determination of these periods would be useful to rubber planters, enabling them to arrange the different operations and to choose the most favourable seasons for carrying them out.

Plants which grow in the tropics at constantly high temperatures are very sensitive to even slight changes of temperatures. At Los Baños, the mean annual temperature is 1° C. lower than at Manila and this slight difference is sufficient to give these two places a somewhat different agricultural geographical situation.

The intense insolation in the tropics influences the processes of assimilation (photosynthetic) by restricting them in a remarkable manner. Numerous plants cultivated in tropical regions require to be protected by the shade of more resistant trees. The coconut palm, even, which grows on the equator, feels the effect of sunshine which, from 10 a. m. to 2 p. m., reduces the photosynthetic processes by almost one half, as has been shown by experiments carried out at the Agricultural College of Los Baños during the summer of 1918. One of the phenomena which has the strongest influence on the life and growth of plants is certainly evaporation. In the Philippines, evaporation, owing to the strong light and high temperature, is naturally intense and rapid, so much so that a month with a smaller rainfall than 50 mm. should be considered dry, while in temperate regions a monthly rainfall of 50 mm. assures the growth of any plant. The requirements of different crops as regards the various meteorological factors and their sensitiveness to different unfavourable meteorological phenomena vary from one crop to another and also for a single plant in the phases of growth. An exact knowledge of the distribution and the frequency of meteorological phenomena in a locality cannot but facilitate the experiments undertaken by the farmer to eliminate or at least to reduce the negative effect of climate. In the Philippine islands the extreme range is from a mean annual temperature of 26.8° C. at Manila to 17.8° C. at Baguio. In the latter locality the rainfall is 4000 mm. in nine months, while in north-eastern Luzon the rainy season is reduced to 6 months and the total rainfall to 2800 — 3500 mm. The climatic conditions are therefore very different: from an absolutely tropical temperature one changes to sufficiently temperate conditions for the introduction and growth of European plants (for example, peas in the valley of Mariquina). It is, therefore, more essential in the Philippines than in other places to undertake a careful

meteorological examination when it is intended to start a farm and to make a choice of different crops.

9 - **Effect of Climate on the Growth of Wheat in Portugal.** — Da Silva Fialho João in *Boletim da Associação Central da Agricultura Portuguesa*, Year XX, Vol. XX, pp. 288-294. Lisbon, Sept., 1918.

In Portugal in general, and especially in the southern provinces, the distribution of temperature and moisture does not always correspond with the requirements of the growth of wheat which, each year, suffers more or less from unfavourable meteorological factors. Among these the most important are moisture, temperature and light.

Moisture. — According to the author, in order to obtain 10 hectolitres of grain per hectare, a good harvest for the district of Beja, the plants should have at their disposition 290,000 kg. of water. The average annual rainfall in the region in question is about 550 mm. corresponding on each hectare to a total mass of 5,500 000 kg. of water, and even admitting that only a third of this water filters and penetrates into the soil, a sufficient quantity always remains.

The table noted below contains data relating to the rainfall collected at the Franzini Meteorological Observatory at Beja during the period 1905-1911

Monthly and annual rainfall in mm. at Béja from 1905 *to* 1911.

	1905	1906	1907	1908	1909	1910	1911
January	155.6	34.6	68.8	83.1	58.0	13.7	18.3
February	2.6	36.0	26.3	1.1	22.7	23.9	29.6
March	25.5	61.0	1.4	45.1	111.8	31.3	98.1
April	40.2	5.0	40.1	34.6	19.8	40.5	70.4
May	12.1	102.6	116.7	20.8	68.9	94.1	28.6
June	51.3	49.9	0.0	59.5	10.5	9.3	26.2
July	3.2	23.2	0.5	0.2	0.2	0.0	1.5
August	0.8	0.0	0.0	0.4	3.0	0.1	34.3
September	27.2	56.7	73.2	5.3	19.3	6.1	1.2
October	95.7	47.6	145.5	30.7	22.2	67.8	94.4
November	131.4	64.8	163.4	149.4	126.6	38.8	81.4
December	66.8	12.8	75.6	83.0	123.9	209.9	3.3
Annual rainfall.	**502.4**	**494.2**	**711.5**	**523.2**	**569.9**	**535.4**	**539.4**

The total quantity of rain would therefore be sufficient, even in this locality, which is one of the driest, to assure a good harvest of wheat. But in Portugal, what hinders the growth of wheat is the bad distribution of rainfall, and the absence of rain during the critical period, when the plants have most need of it.

It should be noted : — (1) that transpiration varies with the different phases of the vegetative period ; it is slight during the first phases, increases

so as to reach the maximum a little before flowering (at the time of forming the ear), then decreases so as to become nil in the very last stages of complete ripening; (2) that evaporation increases with the elevation of the temperature and exposure to the sun; (3) that it diminishes when the water contains salts in solution (nitrate of soda, chloride of potassium, etc.); (4) that the transpiration of the plant and the evaporation of the soil take place almost at the same time, that is to say when the rainfall is generally less abundant.

If, during the critical period, the reserve of water in the ground is not sufficient to supply the requirements of evaporation and transpiration, the harvest will be seriously affected both in quality and quantity.

It is therefore advised: — (1) To work the ground deeply to increase the reserve of water; (2) to crumble the topmost layer of the soil (dry farming), in order to protect the soil against evaporation, by a very finely powdered top layer; (3) to apply nitrogenous manures to diminish transpiration.

In conclusion, it can be said that the success of wheat growing in Portugal depends less on the total quantity of the rainfall than on the distribution, of the rainfall which is generally scarce at the critical period, and for this reason it is necessary to have recourse to all methods by which the reserve of water can be increased and evaporation diminished.

Temperature. — To spring up, develop, tiller, flower, form and ripen its grain, wheat requires a grand total of daily temperatures of from 2000° to 2400° C. These data are confirmed by the observations made at the agronomic Station of the 7th. Agricultural Circle (Santarem), on 3 kinds of local wheat, Durázio molar, Amarelo barba preta and Ribeiro, and are recorded below.

	Durázio molar	Amarelo barba preta	Ribeiro
From sowing to springing up	160°	160°	125°
From springing up to flowering	1 260°	1 260°	970°
From flowering to harvest	960°	960°	930°
Total of the temperatures.	2 380°	2 380°	2 025°

After these observations, applicable to all regions, and which give a more or less exact a idea of the requirements of wheat as regards temperature, the author studies the special conditions which exist in Portugal. Sowing is carried out at two different times of the year, autumn sowing, immediately after the first autumn rains, and spring sowing, as soon as the severity of the winter has passed. In both cases germination takes place at a low temperature, and is then hindered by subsequent cold which, when it is accompanied by excessive moisture in the soil, which frequently happens in Portugal, may destroy the seeds almost entirely.

Wheat can also be damaged by drought during dry winters, which causes feeble tillering, or by too rapid rise of temperature in the spring which, particularly if this rise is accompanied by lack of moisture, causes too early growth and the formation of ears shorter than usual. Scorching is not infrequent ; it causes a decreased yield and a deterioration in the quality of the grain.

Light. — As regards light, wheat always finds in Portugal conditions very favourable to its development, However, the beneficial action of light without the help of moisture and temperature is not alone sufficent to assure a good and abundant harvest.

10 – **Effect of Weather Conditions on the Setting of Fruit in the Plum in Minnesota, U. S. A.** — Dorsey, M. J., in *Journal of Agricultural Research*, Vol XVII, No. 3, pp. 103-126, 1 fig., 13 pl. Washington, June, 1919.

Results of a series of parallel meteorological and biological observations made with the object of determining in what manner and to what extent, weather influences the setting of fruit in the plum.

The author made these observations at the Fruit Breeding Section of the Agricultural Experiment Station of the University of Minnesota, on different species of *Prunus*, during the period 1915-1917. The most important weather conditions which affect the setting of fruit are certainly rain and low temperature, which act in a clearly negative manner and may cause a failure of the crop even when the trees have flowered abundantly.

However, to understand correctly how rainfall and temperature affect the setting of fruit, it is necessary to investigate this phenomenon briefly from an anatomic and physiological point of view.

The period during which the stigma of the plum remains receptive is, at most, one week ; pollination must therefore be effected during this relatively short period to enable fertilisation to take place. All conditions which delay pollination cannot therefore but have a negative influence on the formation of fruit. Further, besides the degree of receptivity of the stigma, there is another phenomenon which helps to still further limit the time during which fertilisation is practicable ; this is the detaching of a part of the pistil which takes place from 8 to 15 days after flowering. And, before the actual abscission of the style is effected, the layer or diaphragm of the modified and thickened cells of the abscise layer constitutes an obstacle to the lengthening of the pollen tube towards the ovary. All phenomena which hinder or slow down the growth of the pollen tube can therefore also influence the setting of fruit in a negative sense.

Now, continuous rain at the flowering season hinders pollination considerably and if prolonged may absolutely prevent it.

In an atmosphere saturated with humidity, the anthers, even if ripe cannot open, and if they are already open, they bend over at once when it commences to rain. Rain weather during the period when the stigmas are receptive is itself sufficient to prevent the setting of fruit. Similar results have been obtained artificially by continuous spraying of trees in flower with water.

The growth of the pollen-tube is in close relation with the temperature. The time required for penetration of the whole length of the style at a temperature of 55° to 60° F. (12.80 to 18.30 C.) is about 6 days for the variety " Surprise ,, . The rate of growth of the pollen-tube decreases proportionally with the lowering of the temperature and, according to GOFF, at 40° (4° F. C.) pollen ceases to germinate.

On the other hand low temperature does not appear to exercise any influence on the date of abscission of the style ; however, it is easily understood that a cold spring at the time of flowering may hinder the setting of fruit by retarding the growth of the pollen-tube up to the moment when the layer of disintegrated cells on the plane of abscission prevents the pollen-tube from growing towards the ovary.

In 1915, 1916 and 1917, there were very light crops of plums at the fruit breeding Station.

In 1915, at the time of flowering and fruit setting the weather was characterised by frequent rain and by low temperature for a week ; consequently the conditions were unfavourable to pollination and to the growth of the pollen-tube.

In 1916, flowering was late and was accompanied, on the one hand, by high temperature favourable to the growth of pollen-tubes, while, on the other hand, there were, especially during the period when the stigma was receptive, rain and wind unfavourable to the emission and dissemination of the pollen.

Lastly, in 1917, rain, wind and low temperature hindered the setting of fruit and caused a very light crop.

In 1912, 1913 and 1918, when the percentage of fruit set was rather high, there was little rain during the flowering and fertilisation periods, and the temperature was, generally, high. In 1914, a year with a very high percentage of fruit set and an abundant crop, there was a high temperature and an absence of heavy rain. The two weather factors which dominate the fruit production of the plum in Minnesota are, then, rain and low temperature, and their negative influence is made particularly striking by the short time during which the stigma is receptive and by the rapid formation of a partition which leads to the detachment of a large part of the style.

11 – **Resistance of Flower Buds and Flowers of the Apricot to Low Temperatures in New Mexico, United States.** — CLEVE HALLENBECK, in *Monthly Weather Review*, Vol. XLVII, No. 4 p. 24. Washington, April, 1919.

It had previously been observed that, in the semi-arid regions and on the high tablelands in the west of the United States, fruit buds of fruit trees and generally the tender parts of plants are resistant to falls in temperature, and that in the plains or moister districts of the east such falls in temperature kill them. The cause of the phenomenon is not yet known ; moisture, the conditions of the soil, altitude, and other factors still unknown may contribute to it and in different degrees. At any rate, air and soil seem to reduce the effect of low temperatures.

The data given below show a notable instance of resistance of the apri-

cot tree (in the valley of Pecos) to very low temperatures, especially afte a period of relatively low humidity, in March, 1918.

Date		Minimum temperatures	State of growth
March	1	− 0.56° C	The tip of the bud is pink.
	2	− 2.22°	—
»	3	− 2.78°	Buds open.
»	4	− 1.67°	—
»	5	− 7.22°	30 % of the buds have opened.
»	6	− 2.78°	—
»	7	− 1.11°	50 % of the buds have opened.
»	8	− 1.67°	—
	9	− 2.78°	—
»	10	− 2.22°	—
»	11	− 7.78°	In full flower.
»	12	− 1.11°	—
»	15	− 2.78°	Flowers begin to fall.
»	16	− 1.11°	—
	18	− 2.78°	—
»	19	− 1.67°	—
»	23	—	Fruit sets.

On March 25, an inspection of the trees at various heights showed that the percentage of dead and damaged fruits scarcely reached 7 %, while 03 % of the flowers had set fruit regularly. Besides, it is thought that in the 7 % are included flowers which did not set fruit and fruit which fell for reasons unconnected with the cold. In the case in question, it may be said that the exceptional cold which prevailed throughout the period between the commencement of flowering and the end of setting fruit caused practically no damage to the trees.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

12 - **American Papers on Soil Science Read at the Philadelphia Meeting of the American Chemical Society.** — *Science*, N. S., Vol. L, No. 1296, pp. 421-424. Lancaster, Pa., Oct. 31, 1919.

Groups of papers read at the meeting of the American Chemical Society at Philadelphia in September, 1919.

Robinson, W. O., Gardiner, R. F., and Holmes, R. S., *The water-soluble manganese of soils.* — Results obtained by frequently shaking 24 samples of soil with distilled water for 8 days. The following deductions were arrived at :

(*a*) 1 to 10 % of the total manganese of soils is soluble in water.

(*b*) Carbon dioxide greatly increases the solubility of the manganese.

(*c*) Surface soils contain much more soluble manganese than subsoils, and this difference is greater the finer the texture of the soil.

(*d*). The amount of oxides of manganese in soil extracts varies from 0-24 parts per million ; it is large enough to affect the bacteriological flora and probably has also a more direct influence on plant growth.

ROBINSON, W. O., *Composition of "ultra clay" from certain soils.* — The author calls "ultra clay" that part of the soil which remains in nearly permanent suspension when it is treated with pure water: it has no organised structure and behaves like any colloid. It is essentially a finely divided hydrous aluminium silicate, with some of the aluminium replaced by iron; it contains also hydrated oxides of aluminium, iron, titanium, silicon, and probably of manganese. On the other hand, the proportion of phosphoric acid and of potash is higher in "ultra clay" than in the soils from which they were derived. Organic matter is always present and probably plays an important part in deflocculating the matter in suspension.

ANDERSON, M. S. AND FRY, W. H., *Composition of soil extracts.* — The salts deposited on the evaporation of the water extracts of soils are much morecomplex than is indicated by a statement of the ions found in the solutions of the extract. There is a marked general similarity between the salts obtained on evaporation of water extracts of soils and those obtained by both natural and artificial evaporation of sea water.

That does not, however, mean to indicate that saline deposits so obtained contain all the salts of natural saline deposits, because the latter represent crystallisation from a composite extract. We may suppose that, under ordinary soil conditions, the above-mentioned complex salts are probably always in solution in the soil moisture itself.

13 – **On the Agricultural Properties of Soils; Research on the Reaction of Soils.** — RABATE, E. (Director of the Agricultural Department of Cher), note by M. SCHRIBAUX, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 35, pp. 846-848 and 854-858. Paris, Oct. 29, 1919.

In order to judge the agricultural properties of soils and water and especially their chemical and physiological properties, among other tests, it is indispensable to know whether they have an alkaline or an acid reaction. To quote only a few established facts; – Acid waters are bad for irrigation; in acid soils advantageous and immediate results may be expected with calcarious fertilisers (marl, lime, composts) and with alkaline manures (dung, liquid manure, slag, ashes). These almost always require phosphatic manures, and natural phosphates, finely ground, give good results. But bulletins of soil analyses issued by agricultural stations are usually silent on the subject of the reaction of soils.

The author describes a new method which he has tested in various geological formations. He proposes to have recourse to logwood dye. This colouring matter has been studied by CHEVREUL, who extracted haematoxylin from it. The wood decoction turns yellow with dilute acids and red with concentrated acids; it is decolourised by suphuretted hydrogen and turns violet with alkalis and alkaline salts; lime gives a blue precipitate.

The method of working is as follows: — 20 cc. of distilled water or rain water is poured into a clear glass tube and 20 drops of the reagent are added; 5 gm. of fine earth, dried and sifted, are then mixed in the solution and left for 15-20 minutes.

Alkaline soils colour the water mauve or violet even when the alkalinity is very slight; calcareous soils that lead to chlorosis give a more

intense reaction. With acid soils the water becomes pale yellow, loses colour, or becomes leaden tinted. Neutral soils do not alter the original colour ; they are very rare.

This is a simple and rapid method which, according to the author, is extremely sensitive.

14 – **Formation of Soluble Matters in Virgin and Cultivated Soils estimated by means of Lowering the Freezing Point.** — Millar C. E. (Michigan Agricultural Experiment Station), in *Soil Science* Vol V. VII, No. 4, pp. 253-257, 2 fig., bibliography of 3 works. Baltimore, 1919.

The whole of the soluble matter in 6 sandy clay and sandy soils, both virgin and cultivated, were separated by washing ; the portions of soils so separated were incubated, and every 40 days their contents in soluble matter formed were determined by means of the lowering of the freezing point (1).

It was found that, in 3 cases, there was a greater production of soluble matter in virgin than in cultivated soils, and the total concentration of the respective solution was also higher. In the other cases, there were only slight differences between the virgin and the cultivated soils. However this may be, the author is led to believe that among the changes caused in soils by cultivation when a sufficent quantity of fertiliser is not restored to them, there is a marked decrease in the rate of formation of soluble matters. To ascertain whether this formation of soluble matter is due to biological or to physico-chemical actions is a problem of great interest, which is being studied along with other problems at the Agricultural Experiment Station of Michigan.

15 – **Toxicity of Alkaline Salts in the Soil.** — Sirgh, T. M. (Oregon Agricultural College), in *Soil Science*, Vol. VI, No. 6, pp. 463-477, bibliography of 19 works. Baltimore, 1918.

The detrimental effect of the accumulation of alkaline salts in the soil has formed the object of study and is well known, but up to the present experimental investigations have only been made on isolated salts or on arbitrary mixtures of those salts.

The author has endeavoured only to study the phenomenon under Oregon conditions and he divided his work into 3 parts : —

(*a*) Determination of the toxic points of chloride, nitrate, carbonate and sulphate of sodium on peas and wheat.

(*b*) Determination of the toxic point for peas and wheat by using a mixture of salts similar to those found on analysing field soil.

(*c*) Determination of the effect of chloride, nitrate, carbonate and sulphate of sodium upon ammonification, nitrification, and nitrogen fixation.

The observations were made on a heavy loam soil, highly productive under normal conditions and under suitable cultivation, but on which, under dry farming, alkaline spots gradually appear, whilst under irrigation, perhaps excessive, the alkali soon appears.

(1) See *R.*, Feb. 1919, No. 154. (*Ed.*)

The salts experimented with are classified as follows in decreasing order of toxicity :— Chloride, nitrate, carbonate and sulphate of sodium both as regards the germination and the growth of wheat and peas and relatively to the ammonifying, nitrifiying and nitrogen-fixing bacteria, the determining factor of this toxic action being found in the percentage of the anion and not of the cation. Small quantities of the different salts used had a stimulating effect both on the growth of the plant and on bacterial activity ; the degree in which this stimulating effect was noticed varied with the plant grown.

The toxicity point, that is to say the degree of concentration at which the detrimental effect is produced, for mixtures of salts in conditions similar to those in fields, agreed closely with that noted for each individual salt ; the toxicity point of the mixture of salts depends, therefore, on the percentage of chloride, nitrate, carbonate and sulphate present and how they are combined ; however, sulphate of calcium tends to lower the toxicity of the chloride, carbonate and nitrate of sodium.

16 - **Chemical Research on Land treated in Different Ways in Denmark.** — Kristensen R. K., in *Tidsskrift for Planteavl* (135 Beretning fra Statens Forsøgsvirksomhed i Plantekultur), Vol. XXVI, Part 2, pp. 335-351, 2 figs. Copenhagen, 1919.

When making experiments on fallow, between 1888 and 1914, at the State experimental station near Ceskov in compensated plots, several chemical tests of the land used in the experiments were made as regards the nitrogen and phosphoric acid contents, and loss by liming. There was thus the means of estimating the effect of different methods of cultivation, on the chemical composition of the soil.

The nitrogen, phosphoric acid and organic matter contents of the soil are closely connected with the method of cultivation, particularly with the manuring and nitrogen-fixing properties of leguminous plants. In fact, land enriched with manure contains 0.058 % of nitrogen, while unmanured land only contains 0.016 %. Where lupins have been used as green manure, without other manuring, the nitrogen content reaches 0.062 %.

During the investigation it was attempted to estimate the degree of accuracy of the work undertaken and with this object samples of each plot were taken from 2 to 10 times, taking each sample from a different part of the plot. The mean error for each sample was from 2 to 3 % on the content of the substance determined ; the soil experimented on was uniform, fine and sandy.

17 - **Denitrification in the Presence of Organic Substances Difficult to Decompose.** — Nolte, O. (Mitteilung aus der landwirtschaftlichen Versuchsstation Rostock), in *Centralblatt für Bakteriologie, etc.* Part II, Vol. II, Nos. 7-9, pp. 182-184. Jena, 1919.

Growing experiments with mustard, in pots containing poor sandy soil with which had been mixed the residue of extracted quinine bark containing lime. Having observed in the 1st series of experiments a sensible dificiency of nitrogen, a 2nd series was carried out in which nitrate of soda in solution was added and a great loss of nitrogen was noted. The author has, therefore, every reason to conclude that even much lignified

quinine bark can be used as a source of energy for denitrifying bacteria, and denitrification is more intense when the quantity of oxygen is smaller, as resulted from a 3rd series of experiments, compared with the 2nd, and in which a double quantity of water was given.

18 – **Effects of the Oxidisation of Sulphur and Nitrification on Potassium and other Soil Constituents.** — Ames, J. W. and Boltz, G. E. (Ohio Agricultural Experiment Station), in *Soil Science* Vol. VII, No. 3, pp. 183-195, bibliography of 21 works. Baltimore, 1919.

Research with a view to the study of the solvent effect on potassium and other soil constituents of oxidation of sulphur in the soil by micro-organisms or "sulfofication" (1), compared with similar effects caused by nitrification. With this object several mixtures of sandy clay soil with chalk, dried blood, potassium silicate, slag, sulphur, and felspar were maintained at a temperature of 30° C. for 19 weeks.

It appears from the observations made that the nitrification of dried and the oxidation of sulphur in the soil mixtures increased the water-soluble potassium, chiefly owing to the sulfofication due to the addition of sulphur. The liberation of potassium was due rather to salts formed by sulfofication or nitrification than to the direct action of acidity on insoluble potassium compounds.

Ammonium sulphate affected the solubility of potassium, independently of the nitrification of ammonia.

On the other hand, calcium naturally present in the soil in the form of silicate or in some other form, was readily attacked by the acidity resulting from nitrification or sulfofication; on the contrary, magnesium compounds were much more resistant to the action of these solvents. Large quantities of aluminium and manganese were converted into soluble forms in consequence of the oxidation of sulphur in the sandy clay soil experimented with, whilst small amounts were made soluble by this action in a basic clay soil.

Nitrification had no effect on aluminium and only a very slight effect on manganese. Finally, no indication was obtained that iron compounds were appreciably affected by nitrification or sulfofication.

ERMANENT
PROVEMENTS,
AINAGE AND
RRIGATION

19 – **Relation of Soil Moisture to Orchard Irrigation.** — Fortier, S., in *The Monthly Bulletin of the State Commission of Horticulture*, Vol. VIII, No. 7 (*Proceedings of the Fifty-first Convention of Fruit Growers and Farmers, at Riverside, California, May 28-29, 1919*), pp. 361-367. Sacramento, Cal., July, 1919.

In considering the importance of soil moisture in orchard irrigation practice, especially in dry zones, we should remember that the greatest need of arid soils in general and of orchard soil in particular is an abundant water supply and a high percentage of organic matter. The water-holding capacity of these soils must next be determined in order to ascertain the quantity of water to apply at each irrigation and how often to irrigate.

The quantity of water drawn up in the soil by capillarity is comparatively small; it is only where a water table is found within a few feet of the

(1) See *R.*, Jan. 1919, No. 24. (*Ed.*)

surface or where there is a body of free water in immediate contact with the soil that capillarity in effective. Gravity acts not only on the free water but also on capillary water and draws it downwards unless a pan or other impermeable material stops it.

The expense of changing furrow irrigation to basin irrigation may be avoided by improving the texture of the soil by the addition of sufficient organic matter.

20 – **The Water Problem in Sicily.** — SALEMI PACE, G., in *L'Italia elettrica*, Vol I, No. 5, pp. 56-61; No. 6, pp. 19-21. Milan, May and June, 1919.

In Sicily there are no long rivers, and even no permanent rivers with a considerable flow of water, but important springs, already utilised by municipalities and for agriculture, are often met with, as well as fairly important waterfalls used by mills and various small industries.

According to the " Relazione sui corsi d'acqua della Sicilia " (Report on the watercourses of Sicily) by the engineer PERRONE, watercourses whose permanent flow is sufficient for hydraulic power would furnish :—

On the northern slopes : 1110 H. P. with ordinary flow and 630 H. P. with the lowest low-water mark.

On the southern slopes : 7745 H. P. with ordinary flow and 5474 H. P. with the lowest low-water mark.

On the eastern slopes : 21 400 H. P. with ordinary flow and 14 200 H. P. with the lowest low-water mark.

Altogether, there may be on the three slopes, in round numbers, 30 000 H. P. with ordinary flow and 20 000 H. P. with the lowest. These limits might be greatly extended, by regulating the torrential water courses, which rush down from the high vallies, and by utilising them in electrical power stations.

According to information collected by the author, there are actually in Sicily 35 577 hectares of irrigated land; the position which they occupy would permit of irrigating a further 111 000 hectares; it is a question of ascertaining whether the island has at its disposal the quantity of water necessary for this irrigation.

According to M. NICOLO TURRISI COLONNA, whose experiments have been made in clay loam soils, a total of 8658 cubic metres of water would be necessary, and according to M. INZENGA, whose experiments have been made on arid lands, of calcareous tufa, 147 000 cubic metres of water in all would be required to irrigate 1 ha., once a week, for 7 months of the year. The author estimates that the coefficient of 0.7 litre per ha. per second might be adopted as the average consumption of water for irrigation, that is to say that, to give weekly irrigation during an uninterrupted period of 7 months, as the soil of Sicily requires, at least 11 000 cubic metres of water per ha. would be required. This figure corresponds closely with the averge of those obtained by M. TURRISI COLONNA and by M. INZENGA.

The " Commissione Reale per gli studi e proposte relativi alle opere di irrigazione " (Royal Commission for study and proposals relating to irrigation works) has adopted the coefficient of 0.5 litres per second but, ac-

cording to the author, this coefficient is too low and should be increased to 0.7 litre. To irrigate a further 111 000 ha. it would therefore be necessary to have at disposal during 7 months, 11 000 cubic metres × 111 000 = 1 221 000 000 cubic metres of water.

Estimating the annual rainfall at a general average of 500 mm. for the whole island, we have a total quantity of 12 730 million cubic metres of which about $^{7}/_{10}$ represent water which evaporates, that which feeds the springs and that which is used by plants; while $^{3}/_{10}$ (say 3819 million cubic metres) run off on the surface of the ground, denuding the soil and devastating it, and end by flowing into the sea. It is precisely from this amount of water that the quantity required for irrigating the above mentioned 111 000 ha. must be taken. This could be done by constructing artificial lakes or dams to retain the water at the mouths of the vallies.

The author then describes the means proposed or proposable by which the water could be collected and utilised.

Filter galleries serve to intercept, upstream, the water which circulates in the alluvial deposits of the bed and brings them to the surface. But there is not always subterranean water to set free, in the ravines or rivers with large and deep beds; their existence depends indeed on 2 factors: — (1) The presence upstream of sufficiently abundant springs; (2) The permeability of the alluvium which forms the bed of the ravins when it is not very strong; for the work of the filter galleries is not to collect and distribute rainwater but to supply irrigation during the dry season, which is only possible when they hold the water from hidden springs.

Underground dams are useful in narrow and deep vallies cut in calcareous tufa at the bottom of which abundant springs rise, some visible, others, more numerous, underground, filtering through the banks.

Mecanical conduits, chiefly intended for the orange gardens and the different irrigated cultivations in the low vallies and in the coastal plains, are very numerous; however much deep flowing water and phreatic (1) water discharge visibly into the sea. Many projects have been made to capture these waters; they consist in the construction of *underground dams* in clay strata. To hold underground water, an ancient method is always employed in the province of Palermo which consists in the construction of underground canals by means of wells called " pozzi a ripiano "; at present the construction of similar works in the locality of Etna is being investicated.

21 – **Irrigation and Watering in Syria and Palestine.** — PARMENTIER, PAUL, in *Comptes rendus de l'Académie des Sciences*, Vol. 169, No. 8, pp. 391-393. Paris, Aug. 25, 1919.

After having pointed out how defective the system of irrigation and watering in Syria and Palestine is, the author suggests a new method which consists essentially in replacing the cisterns for watering trees and irrigation trenches, or the partial submersion of irrigated plots by hollow cy-

(1) " Phreatic ,, is a term coined by Hay (*14th. Rep., U. S. Geol. Surv.*, II, 16) to designate underground water that can or may be tapped. (*Ed.*)

linders, open at the ends and with small holes pierced at the side of one end at a height of about 10 cm. These cylinders, in cast-iron, in concrete or in earthenware, have a maximum capacity of 20 litres for plantations of trees and less for the kitchen-garden plants. The end provided with lateral holes is sunk in the ground. These cylinders are buried to a depth slightly above that of the rootlets along the spaces between the trees.

In this manner 80 litres of water, completely used by the plant, would replace satisfactorily for the same time the 600 litres at present used, a considerable economy of 520 litres per tree would result and, in addition, there would no longer be damp air under the trees, nor toughening of green vegetables.

22 – **The Influence of Farmyard Manure on Clover.** — Russell, E. J. (Director of the Rothamsted Experimental Station, Harpenden), in *The Journal of the Board of Agriculture*, Vol. XXVI, No. 2, pp. 124-130. London, 1919.

An enormous quantity of work has been carried out during the last 35 years in connection with the manuring of different plants, but, in spite of its great importance in the crop rotation clover has been omitted, perhaps because of its liability to " sickness ", which renders it unsuitable for a continuous series of experiments. The author carried out a series of field tests on this subject ; he compared the residual value of ordinary farmyard manure and of farmyard manure cake-fed cattle, of shoddy rape cake superphosphate bone meal basic slag, on clover following a wheat crop on land where clover had not been grown for over 14 years. The manures were applied 1, 2, 3, and 4 years before the clover.

None of the manures, except farmyard manure, had any appreciable effect on the clover ; applied 2, 3, and even 4 years beforehand it produced notable increases in the yield of clover. It had, further, a distinct effect on the wheat crop grown after the clover, the heaviest crop of the latter having been followed by a heavier wheat crop. In conclusion it should be noted that the action of the farmyard manure only affected the first cut, the yield of the second cut being approximately the same with farmyard manure as with the other manures.

To sum up, farmyard manure has an important residual effect on clover which should be taken into account in estimating its influence on the croprotation.

23 – **Use of Natural Phosphates in Rice-fields in Indo-China.** (1) — Bussy (Directeur du Laboratoire d'analyses de l'Institute scientifique de Saïgon), in *Bulletin agricole de l'Institute Scientifique de Saïgon*, Year I, No. 9, pp. 265-266. Saigon, Sept., 1919.

In Cochin-China the soils of the rice-fields are not all of the same kind. They can be classed in two categories : —

(1) Soils containing humus, which occupy the rich alluvial plains of the west, as well as the bottoms of the valleys of the streams and rivers, flow-

(1) On the subject of phosphatic manures in rice fields see : — Manurial experiments with " tetraphosphate " in Italy, in *R.*, Feb. 1917, No. 142. (*Ed.*)

ing from the eastern regions. These are heavy yielding rice-fields. They contain up to 10 % of organic matter in different stages of decomposition, and 0.2 to 0.3 % of nitrogen. Their richness in potassium is sometimes fairly good, but they nearly always lack phosphoric acid and lime.

(2) The soils occupying the slopes of the valleys in the eastern region. They are worked as rice-fields by retaining the water by means of terraces. They are of a sandy clay nature, sometimes even entirely sandy, poor in all fertilising elements, and lacking humus. In these soils phosphates employed alone have no appreciable effect.

In the rice- fields of the first type natural phosphate (phosphoric acid in a tricalcic state, associated with carbonate of lime) possesses two distinct actions, both conducing to the same useful effect. The first is the action of carbonate of lime which, in promoting nitrification, renders the nitrogen in the organic matter assimilable, the second, that of phosphate of lime which, owing to carbonic acid dissolved in the soil, water enters slowly into solution. The phosphoric acid then combines in an insoluble state with the iron and aluminium in the soil ; it can then be attacked by alkaline carbonates, and especially by carbonate of ammonia, which is formed by contact of carbonate of lime with nitrogenous organic matter.

Parallel to these two reactions another may occur, due to the solvent action of free organic acids which exists in soils containing a strong proportion of humus.

What happens in the soils of the second type lacking organic matter and whose reserves in fertilising elements are slight, ?

The action of carbonate of lime, brought by the phosphate, would have a somewhat harmful effect in provoking too active nitrification, which would tend to diminish the already-too-slightreserve of nitrogen.

As in the rich rice-lands, tricalcium phosphate will be subjected to the action of the dissolved carbonic acid, and phosphate of iron and aluminium would be formed ; but there the reactions would stop for nitrogenous organic matter is wanting and cannot produce carbonate of ammonia.

The phosphoric acid remains then in the state of phosphate of iron and aluminium which the plant can scarcely use. This explains the inefficiency of natural phosphates, employed alone in sandy soils and those not containing humus. In these soils, to obtain a useful effect with this manure, it would be necessary first to render the phosphoric acid soluble. This would be effected to a certain extent by making composts of organic matter and phosphates.

The author recommends the following economic formula :— Mix peat and natural phosphate in the proportion of 1000 kg. of peat to 20 kg. of phosphate. The heap, exposed to the air for 1 year, should be turned over from time to time. The solubility of the phosphoric acid would be increased by adding to the mixture 5 to 10 kg. of sulphate of potash. This addition of potassic salt would give a complete manure.

This compost could be used in quantities varying from 15 to 30 tons per hectare. It is well to use only finely ground phosphates, as the fertilising action of a phosphate depends on its fineness.

24 – **Potash in Tunis and Morocco.** — I. BOURGUIGNON, R. (Services chimiques de guerre), The extraction of bromine and potash in Tunis, in *Bulletin de la Société d'encouragement pour l'industrie nationale*, Year CXVIII, 1st. half-year, No. I, pp. 140-147. Paris, 1919. — II. Search for potash in Morocco. *Le phosphate et les engrais chimiques*, Year. XXVIII, No. 1292, p. 282. Paris, 1919.

I. — Before the war, bromine came from the " Kalisyndicat " of Stassfurt, which had gained possession of the European market, and from the American union of producers of bromine. In consequence of the necessity of assuring the manufacture of asphyxiating and lachrymatory gas containing bromine, the bromine industry was established in Tunis at the suggestion of the War Chemical Services.

The mission sent to Tunis to search for salt deposits and salt lakes, in Tunis, in December, 1915, chose Sebkha el Melah, a natural depression of 15 000 to 20 000 ha,. stretching along the coast of Tunis near Zarzis, and consisting of a dried-up salt lake, which, under the salt layer, contains mother liquor at 27°.3 B, with the following composition :—

Chloride of sodium	158 gm. per litre
Sulphate of magnesium	22 » » »
Chloride of magnesium	141 » » »
Chloride of potassium	13 » » »
Bromide of magnesium	224 » » »

The French department of war chemicals drew attention to the advantage of simultaneous extraction of the bromine and potash salts.

The extraction of potash from the mother liquor had been carried out by the department of public works in Tunis at the salt deposits of Mégrine, using the URBAIN process, which consists in precipitating the potash by fluosilicic acid, obtained as a by-product of the superphosphate factory at El-Afrane. This process was too costly, and the manufacture was stopped.

In the salt deposit of Sfax, and at Zarzis, the MERLE process with magnesium liquor was used ; but it was also abandoned, for rational salt-making can yield a kind of artificial carnallite, more or less charged with choride of sodium and sulphate of magnesium ; this is sebkhaïnite which the mother liquor gives at 36° B, containing scarcely any choride of potassium, and preserving all the bromine. The composition of sebkhaïnite collected above 33° B does not differ much from the following :—

Chloride of potassium	19.5 %
Chloride of sodium	10
Chloride of magnesium	27.2
Sulphate of magnesium	9.3
Water and insoluble matter	34

By the end of February, 1919, the factory at El Henèche had thus manufactured, more than 2 500 tons of choride of potassium of from 35 to 95 % strength.

The factory at Aïn es Serah, constructed by order of the Tunis government, on the experience gained at El Hanèche, will be capable of producing 50 000 tons of sebkhaïnite, which can be converted into choride with 22-23, or 60, or 90 % of potash.

The bromine industry has served as an introduction to that of potash, and Tunis will be able, henceforth, to furnish an important tonnage of salts of potash in the Mediterranean region.

II. — From investigations made in Morocco, it was found that the Moroccan trias sometimes contains chloride of potash. Potassic salts are also found in the salt lands on the banks of Lake Zima, situated between Saffi and Marrakech.

The conclusion that competent persons, who have studied the question, have arrived at is that potassic salts would be difficult to work in triassic soil ; on the contrary, it would be relatively easy to extract them from the salt deposits of Lake Zima. Samples of salt earth from Lake Zima contain up to 2.05 % potash ; the waters of the lake contain an average of 75 gm. of potash per litre. The richness in potash of the waters of Lake Zima would therefore be much greater than that of Sebkha el Melah (Tunis).

Appreciable quantities of choride of potash have also been discovered at Guercif, Agourai, El Boroudj, Figuig, Taourirt, Martimprey du Kiss, Khemisset, Dar Ouled Zidouh, Rhala, Demnat, and Debdon. Prospecting licenses for salts of potash have been asked for at Souk-el-Orba de Tissa.

25 - **Fertilising Action of Sulphur on the Vine.** — See No. 60 of this *Review*.

26 - **The Compound Interest Law applied to Plant Growth.** — BLACKMAN, V. H. (Imperial College of Science and Technology, London), in *Annals of Botany*, Vol. XXXIII, No. 131, pp. 353-360. London, July, 1919.

The author, referring to work he undertook in collaboration with F. GREGORY at the Cheshunt Experimental Station on the growth of cucumbers and to work of earlier writers, especially of NOLL and his pupils on the sunflower, hemp and tobacco, observes that the growth of annual plants, at any rate in their early stages, follows approximately the law of compound interest. As a matter of fact, the dry weight attained by a plant at the end of any determined period depends on : — (*a*) the weight of the seed at the start, which represents the initial capital with which the plant starts ; *b*) the average rate at which the plant makes use of the material already existing to produce new material, which represents the interest on the capital employed ; (*c*) the period of growth.

The simple equation which best expresses the growth relations of an annual plant is $W_1 = W_0 e^{rt}$, where W_1 represents the final dry weight of the plant, W_0 the initial weight, e the base of the natural logarithms, r the rate at which the material already present is used to form new material, t the length of time considered. The term r is an important physiological constant, for it is a measure of the efficiency of the plant in the production of new material, and the greater the return of the plant in proportion to the material used, the higher is r. The rate r may therefore be called *the index of the efficiency of production of dry material* or *efficiency index*, and it not only indicates the productive efficiency of the plant, but it is also the exponential term in the equation which expresses the growth of that plant. For example, in some sunflowers, the mean *efficiency index*, for the period

ending with the formation of the inflorescence, may reach 0.1763, or 17.63 %, per day.

The author suggests that in all experiments dealing with vegetative growth, such as water or pot cultures, the *efficiency index* should be calculated; in this way the relative productive capacity of different plants at different periods would be determined, as well as the effect on the index caused by external conditions. A slight difference in the efficiency index of two different plants (difference due to a slightly greater rate of assimilation or to a more economical distribution of material produced between the leaves and axis) may cause a notable difference in the final weight; in oats, for example, a 6 % increase in assimilation may cause, after 100 days, an increase of 30 % in the production of dry material. The data of earlier writers show that the *efficiency index* is higher during the early stages of growth and that it then decreases slightly in the sunflower, hemp, and tobacco: it falls sharply at the beginning of the reproductive period, that is to say when the inflorescence first appears. There is also evidence that annual plants may lose considerably in dry weight at the end of their period of growth.

27 - **Variations in the Respiration of Leaf Cells with Age.** — BÉZAGU, M., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXIX, No. 16, pp. 701-702. Paris, Oct. 20, 1919.

The various physiologists who have dealt with this question have correlated the intensity of respiration to the carbonic acid gas set free during 1 hour by 1 gramme green weight. They have thus ascertained that the activity of respiration decreases with the growth of the leaf. The same would be the case with the relation $\frac{CO^2}{O^2}$, the study of which has been the object of a recent work by M. NICOLAS (1).

The author, in his researches, has tried to correlate the intensity of respiration not to the gramme-hour, a purely physical unit, but to a physiological and histological unit, the cell respiring during one hour. For this he has correlated the respiration to the organ-hour under the following preliminary hypotheses: —

(1) Two mature leaves of the same species whose surfaces are very equal have the same number of cells.

(2) This number is the same as that of the young leaves which have not yet reached their full dimensions, but in which cell division has completely ceased. This latter supposition is very probable if species are considered in which observation shows that the leaf grows very regularly and constantly has, when mature, an approximately equal surface.

The author's experiments were made with leaves of *Robinia Pseudacacia*, *Pinus sylvestris*, *Cobaea scandens*, *Ligustrum vulgare*, *Althaea*, *Loroglossum hircinum*, *Cercis Siliquastrum*, and have led to the following results: —

(1) The intensity of respiration of the cell, very slight in young cells,

(1) NICOLAS, *Revue général de Botanique*, Vol. XXX, No. 355, 1918. (*Author*)

increases up to a maximum, which corresponds approximately to the moment when the leaf reaches its full growth ; as the leaf grows older the intensity of respiration decreases.

By referring the results obtained to the gramme, the known results can be verified, namely that the intensity of respiration decreases with age.

(2) The respiratory quotient of leaves, slight when they are young, increases very rapidly up to a maximum, then decreases very slowly until the leaf is mature ; finally it continues to decrease regularly after the leaf has reached its full size.

The maximum in the variation of the respiratory quotient is a result which had not previously been recorded.

It is of importance to note that the respective maxima of the respiratory intensity and quotient correspond with very distinct periods of the evolution of the cell ; the former, in fact, is reached by the leaf cells when they have become completely mature, whilst the latter appears when the leaves are quite young, in the bud or shortly after its opening.

PLANT BREEDING

28 – **Plant Breeding at the Phytotechnic Station of Gayerovo, Brazil.** — ZEDNECK and GAYER, CARLOS, in *A Lavoura*, Year XXIII, No. 1-2-3, pp. 12-18. Rio de Janeiro, 1919.

The Station of Gayerovo makes comparative cultural tests and carries out individual and mass selection for cereals, peas, ground nuts, and cotton.

CEREALS. — In the work of improvement of cereals the following characters are considered : Number of culms ; number of grains per plant; weight of 1000 grains ; compactness of the ear ; weight of the ear ; weight of straw; strength and elasticity of the culms ; resistance to diseases form of the leaves ; weight of the whole plant.

Oats. — Comparative cultural tests have been carried out with the North American varieties Aurora No. 831, Fulghum No. 408, Red Rustproof No. 518-3 and also with the South American oat Excelsior of Rio Grande-de-Sol. The germination faculty of this last was 87 %, against 25, 13, and 10 %, respectively for Aurora, Fulghum and Red Rustproof. In addition to their feeble germination faculty the North American kinds proved very susceptible to rust, in strong contrast to Excelsior which resisted rust completely.

Wheat. — Barletta wheat was dealt with by mass selection with good results, and a genealogical selection was also carried out ; 11 different lines are under study.

Comparative cultural tests with 4 Japanese wheats : Sgatiengo, very early (ripens in 3 months); Eshima, with large, flattened ears ; Shiroboya beardless and early, with ears like Squarehead; Shiro, like Sgatiengo, but later ; have given interesting results. Thus it has been found that the weight of 1000 grains is in grammes : Sgatiengo, 32.01 ; Eshima, 47.0 ; Shiro, 33.7 ; Shiroboya, 39.9.

Rye. — Nine pure lines are under study ; in mass selection only grains of ears weighing at least 2.3 gm. are gathered.

PEAS. — The best results are given by the kinds : — Bliss Everbearing (dwarf and prolific) ; Burst's Early Morning Star and Prosperity (very

early); sown on the 9th September the Kind Prosperity yielded its crop on November 26. The kinds Alderman, Duke of Albany, Telephone, Champion of England, Marrowfat were completely destroyed by *Erysiphe Pisi* D. C. (= *E. communis* Wallr.).

Potatoes. — In selecting potatoes the qualities aimed at are : — heavy yield good quality, and resistance to diseases. The kind Silezia fulfils these conditions. In the work of sorting the following characters are considered : — Total number of tubers ; total weight of tubers ; resistance to diseases ; weight of the whole plant ; etc.

Ground-nuts. — Varieties studied : — The ground-nut cultivated by the Nhambiguara, Parecis and Tupis indians in Matto Grosso ; Hespanhol Rasteiro ; Tennessee Red Peanut ; Gayerovo variety.

The variety cultivated by the natives of Matto Grosso is noted for the size of its seeds, four times as large as those of the common kinds, so that 100 of its seeds weigh, on the average, 357 gm. against 55.16 gm. for the variety Hespanhol, 5673 gm. for Tennessee and 6973 gm. for Gayerovo.

Cotton. — The variety Expresso is at present under study.

Maize. — Attention is directed almost exclusively to Golden Dent, with the object of preserving the purity and improving the quality of this maize, which appears to be best suited to the district. The genealogical selection has been started with the seed of a Campea Cob (prize winner at Rio de Janeiro) and of 4 other cobs selected out of 400.

At present it is possible to say that the plants produced by the Campea cob are distinguished from all the others by the vigour of their growth and, by, what is still more important, their earliness.

Other North American and Brazilian varieties, such as Dr. Assis Brazil, Horsting Prolific, Gerrick, Laguna and Loveliest are also under study.

29 - **Trials of Hybridisation Between Some Species of *Triticum*, in Denmark.** — Kaja- nus, B., in *Nordisk Jordbrugsforskning Forening*, Part 5, pp. 224-226. Copenhagen, 1919.

Results of hybridisation work undertaken since 1911 with *T. dicoccum*, *T. Spelta*, *T. turgidum*, *T. vulgare*, and *T. compactum*. The facts examined are of considerable interest, both as regards the appearance of new combinations of characters and as regards the morphological expression of each factor and the general action which they exercise in determining well defined genotypes.

From the cross *vulgare* × *dicoccum* were obtaind in F_2 forms very much resembling *Spelta* and which, crossed with *vulgare*, dominated the characters of the latter in a similar manner to what has been noted in the cross *Spelta* × *vulgare*. On the other hand, from the cross *vulgare* × *turgidum* forms of the *Spelta* type were obtained which, crossed with *vulgare*, behaved as recessives, in the sense that the hybrids resulting had the characters of *vulgare*.

Some new " Squarehead " types deserve to be noted ; they resulted from crossing *vulgare* × *dicoccum*, *vulgare* × *turgidum*, *vulgare* × *spelta*.

The hairiness of *Spelta* and the dark colour of the ears are due to a

single factor, *G*. In the hybrids *Spelta* × *vulgare* the action of this determinant is very slight, even in the homozygous state, the pubescence is confined to the upper extremity of the covering glumes and the hairs are not so dense as in *Spelta*.

Dicoccum also possesses the factor *G*, and, in addition another factor *B*, which has a simple chromogenic action, producing a red brown colouring.

Turgidum presents a new determinant, *H*, relating to hairiness: hairs long, easily seen, spread over the whole surface of the covering glume. The red brown colour of *turgidum* depends, on the other hand, on the same factor *B* as in *dicoccum*.

Regarding the action of the factors generally it wasfound that, in some crosses, certain factors unite freely according to the laws of combination of characters, while, in others, they show absolute incompatibility, that is to say, they are incapable of uniting in a single combination. Thus, in a series *vulgare* × *turgidum* the factors *H* and *B* in F_1, blended normally so that, in the F_2 generation, the ordinary divisions, forseen according to MENDEL's law, of 9 hairy red brown individuals, 3 hairy yellow, 3 glabrous red brown and 1 glabrous yellow were noted.

In a cross "Jämtland" wheat × "Sammet" wheat an absolute incompatibility was revealed, on the contrary, between the too above-mentioned characters, which gave in F_2 hairy red brown, hairy yellow and glabrous red brown individuals in the proportion 2 : 1 : 1, while the combination glabrous yellow was excluded.

Similar phenomena are repeated for *G* and *B*. As for the colour of the grains, it depended in certain cases on a polymerous factor, namely dimerous for Sammet wheat and trimerous for Teiss wheat. The author deduces from the results of these hybridisation trials, elements which help to establish the degree of relationship between the varieties studied. There were 2 series : on the one hand *dicoccum*, *durum* and *polonicum*, and on the other hand *Spelta*, *vulgare*, and *compactum*.

30 – **Transmission of Dwarf Character in Marquis Wheat, in Canada.** — CUTLER, C. H., in *Journal of the American Society of Agronomy* Vol II, No. 2, pp. 76-78. Washington, Feb., 1919.

When he was professor at the University of Saskatchewan (Canada), the author noticed the occurrence of a dwarf plant (9 inches high) in a field of Marquis wheat. Desiring to study this phenomenon from a genetic standpoint, he selected 200 typically normal heads and sowed separately 20 seeds of each head. Even before harvest it was easy to notice the characteristic variations in some rows, specially in row No. 186, which included : — plants from 9 to 40 inches high ; normal tall plants ; dwarf plants ; intermediate plants. As a whole these plants had the characters of descendants in F_2, confirmed by the following facts : — (1) in subsequent generations of dwarf plants the proportion of dwarfs reached 100 % ; (2) the tall plants produced exclusively tall normal plants ; (3) the intermediate plants produced 25 % dwarfs (Mendelian ratio = 1

dwarf : 3 normal). Both for wheat and oats the dwarf character would, therefore, depend on a single determinant, recessive in relation with the determinant which dominates the normal growth of the plants. The occurrence of dwarf forms of wheat had previously been observed and studied by RICHARDSON and by FARRER in Australia.

31 – **" Gironde Inversable " and " Rieti Inversable ", New Kinds of Wheat obtained at Nages, France.** — VIEULES, G., in *Revue internationale de génétique*, Year VI, No. 7, pp. 197-208. Paris, July, 1919.

The Director of Agriculture for the Department of Tarn recommends for that region the two wheats Gironde (from southern France) and Rieti (from central Italy). While these wheats have excellent qualities they have the defect of being very subject to lodging. The author, after having described in a general manner the work of the Central Genetic Institute of Nages in his article, announces that he has created 2 non-lodging types of *Gironde* (Gironde inversable) and of *Rieti* (Rieti inversable), which will be placed on the market in 3 years. Besides *Gironde inversable*, the author mentions other kinds of Gironde type, *Gironde aristé*, the ear of which is much longer and the appearance much superior to that of the original kind, and *Gironde doré*, which is more vigorous and earlier than the common type.

32 – **Morphological and Cytological Researches on the Hybrids *Aegilops ovata* × *Triticum vulgare*.** — BALLY, W., in *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. XX, Part 3, pp. 177-140, 3 fig., IV pl. Leipzig, 1919.

In 1854, at Montpellier, GODRON made the cross *Aegilops ovata* × *Triticum vulgare* successfully and he obtained in the F_1 generation plants which, fertilised with pollen of *Triticum*, gave in RF_2, hybrids with intermediate characters, but decidedly nearer *Triticum* than *Aegilops*. These hybrids remained constant in successive generations, with a gradual decrease in fertility : it was therefore a case of " intermediate heredity ".

The author, after reproducing the hybrids of GODRON, submitted them to a wide cytological study ; he thus approached one of the most delicate questions of modern genetics : the transmission and the behaviour of characters in relation to the number and form of the chromosomes (1) and to the phenomena which occur in the processes which lead to the differentiation of the germ cells.

HYBRIDS F_1 *Aegilops ovata* × *Triticum vulgare*. — They are distinguished by the following characters : —

(1) Large number of shoots, as in *Aegilops*.

(2) Straw straight.

(3) Ears elongated with 5-7 spikelets (*Aegilops* has 3-5, *Triticum* has up to 15).

(4) In the lower spikelets, the glumes are prominently keeled and bearded ; in the upper spikelets the keel is scarcely apparent and the number of awns may reach 3.

(1) See *R.*, Oct.-Dec. 1919, No. 1116, which defines the cytological terms used in this article. (*Ed.*)

(5) The covering glumes have a single awn and a lateral notch (as in *Triticum*).

(6) All these hybrids have bad pollen ; the granules, slightly filled with plasma, have a wrinkled surface ; starch is completely absent.

Formation of sexual cells in the hybrids. — *Aegilops* and *Triticum* differ both in the number and in the form and size of their chromosomes. *Triticum* has 8 chromosomes, twice as big (wide) as the chromosomes of *Aegilops* which number 16.

Cross between *Aegilops ovata* and *Triticum vulgare*.

On the left : *Triticum vulgare*
On the right : *Aegilops ovata*
In the middle: Hybrid between these two species.

Prophase. — In the F_1 generation, according to present day opinion, the 8 chromosomes of the grain of pollen ought, in diacinesis, to unit with 8 of the chromosomes of *Aegilops* to constitute 8 pairs of "twins", while 8 of the chromosomes of *Aegilops* should remain isolated. However, the preparations obtained by the author did not enable him to establish with certainty whether all went in accordance with the preceding scheme. There were,

it is true, some isolated chromosomes, but it was not possible to be sure that they were precisely those of *Aegilops* and, on the other hand, the differences of form and size between the 2 groups of chromosomes do not become visible until much later. It even happens in certain cases that the " twins " are absolutely identical and almost give the impression of being a chromosome which has been divided in its length, anticipating the phenomena of the subsequent homotypic division (by a process similar to that which ROSENBERG has studied in hybrids of *Hieracium*). The dividing in two of the elements should in any case occur in one manner or another, as results from the examination of some preparations where, in correspondence with the nuclear spindle, a number of haploid chromosomes greater than 12 (4 *Triticum* + 8 *Aegilops*) is found.

During heterotypic division or of reduction, the author frequently notes the presence of multipolar spindles, and he thinks it possible to add to the already so numerous causes attributed to the phenomenon, the mechanical reason of the fact of incompatibility between the dimensions of the spindle and those of the chromosomes.

Metaphase and anaphase. — The emigration of chromosomes towards the poles is not carried out with equal speed for all elements ; the chromosomes of *Triticum* seem to reach the pole before those of *Aegilops*. In this case, it is possible that a group of chromosomes exclusively belonging to *Triticum* condense and isolate themselves with the nuclear and cellular partitions which belong to it and give rise to an element in which all the chromatic substance is derived from a single generator. In his determinations the author has examined the mother cells of pollen which are very suitable for research of this kind. We have seen above that GODRON in rehybridising F_1. *Aegilops ovata* × *Triticum* had obtained, in $R\,F_2$, a hybrid which transmitted its characters without alteration and maintained itself constant from one generation to another. The author attempts to explain this phenomenon of intermediate heredity in the following manner : — in the reduction division of the parent cells of the macrospores daughter cells may be formed, in a similar manner to what has been observed in the pollen mother cells, in which the nucleus contains substance of *Triticum*. only. These alone will be capable of developing. Now if an egg cell so formed and consequently containing 4 chromosomes of *Triticum* alone is fertilised by pollen of *Triticum* containing 8 chromosomes, an individual with 12 chromosomes (diploid) will be obtained which is absolutely homozygous and constant. In the present case such a hybrid constitutes the species *Aegilops speltaeformis*.

Homotypic division. — The boundary line between the processes of heterotypic and homotypic division is not very clearly defined, because of numerous irregularities which occur in the distribution and in the movement of the chromosomes which often cause the formation of elements constituted by chromatic substance derived from one only of the two generators.

The renewing of the homotypic divisions which takes place in the tetrads already formed and which leads to the formation of polynuclear pollen grains should be noted.

Up to the last stages of meiosis the differential characters of the *Triticum* and *Aegilops* chromosomes, which have become increasingly noticeable, remain unaltered and thus give a further contribution to the theory of the individuality of the chromosomes.

33 – **The Occurrence of Dwarf Plants and the Transmission of that Character in Pure Lines of Victory (Seger) Oats, in the United States.** — WARBURTON, C. W., in *Journal of the American Society of Agronomy* Vol. II, No. 2, pp. 72-76, 1 pl. Washington, Feb., 1919.

In 1916, at the Aberdeen Station (Idaho), the author noticed, in a row of 20 plants of Victory (= Seger of Svalöf) oats, the occurrence of 8 quite abnormal specimens. The plants tillered abundantly, so that low tufts were formed with rather stiff erect leaves at the base ; the culms, few in number, are less than 10 inches in height and bear generally a very small inflorescence with 3 or 4 spikelets ; these dwarf plants are very late and frequently their seed is not ripe before the first frosts. In 1917, the author sowed a few matured seeds and obtained progeny all of which were dwarf. In the original row of dwarf plants there were 12 normal (tall) plants ; 40 seeds were taken from each of 10 of these plants and sown in 10 separate rows. In 1917, the resulting plants were examined and it was found that 4 of the plants had produced normal plants exclusively, while the other 6 had a mixed progeny of tall plants (168) and dwarf plants (66), in the ratio 2.55 : 1, which corresponds fairly well with the Mendelian ratio 3 : 1 observed in F_2 of the hybrids with 2 allelomorphs, one of which is dominant. In this cases the " normal " character would be dominant.

Successive generations would then be constituted by homozygous plants (*dwarfs* and *normal*) which remain constant, and by heterozygous plants (*normal* in appearance owing to dominance) which would divide in the following generation into dwarf and normal plants.

Subsequent research undertaken at other Stations (Ithaca and St. Paul) confirms the results obtained at Aberdeen. However, the author cannot fix the causes or cause of the sudden appearance of abnormal plants in Victory oats.

34 – **Transmission of Maternal Characters in *Humulus japonicus* var. *albomaculata*, in Denmark.** — WINGE, O., in *Comptes rendus des travaux du Laboratoire Carlsberg*, Vol. 14, No. 2, pp. 2-11, 3 fig. Copenhagen, 1919.

Normal *Humulus japonicus* with green leaves (= *norm*), crossed with the *albomaculata* variety (*Humulus japonicus albomaculata* = *albm*), produces in F_1 progeny exclusively normal in the case ♀ *norm* × ♂ *albm*, and progeny exclusively mottled (with white green watered leaves of the *albomaculata* type) in the case ♀ *albm* × ♂ *norm*.

In F_2 there were :

♀ *norm* (*norm* × *albm*) × ♂	*norm* (*norm* × *albm*)	*norm* 78, *albm* 0
♀ *norm* (*norm* × *albm*) × ♂	*norm* (*norm* × *albm*)	*norm* 31, *albm* 0
♀ *norm* (*norm* × *albm*) × ♂	*albm* (*albm* × *albm*)	*norm* 32, *albm* 0
♀ *albm* (*albm* × *albm*) × ♂	*norm* (*norm* × *albm*)	*norm* 0, *albm* 29

The *albomaculata* character therefore is only transmitted on the maternal side and the examination of the progeny up to the F_1 generation fully confirms that assertion. This method of transmission can be explained if it is assumed that the character in question is absent from the nucleus of the egg cell (in this case the Mendelian laws would hold good), but is present in the cytoplasma. In this case it would still have to be proved whether the phenomenon is attributable to the chromatophores or to the plasma itself. The entire absence of *white* forms (albinos) and of *normal* forms in the progeny, which, in any case, are *albomaculata*, shows that this latter character is really due to a special structure of the plasma of the egg cell.

35 - **Selection of Coffee and Cocoa at Surinam, Dutch Guiana.** — Stahel Geroldi in *Departement van den Landbouw in Suriname, Bulletin* No. 36, pp. 1-23. Paramaribo, Feb., 1919

By hybridisation followed by selection, shrubs also can be improved in respect of the yield and quality of their products. But the time required to effect these improvements is naturally very long, so that to obtain practical and assured results the work must be continued for several decades. On the other hand, vegetative reproduction, by graft, of individuals selected for their superior qualities, offers a quick and sure method of improving plantations.

Methods of this kind were and are applied on a large scale and with success in the United States, especially in Florida and California, in replanting orange gardens. In the article reviewed, the author published the results obtained at Suriman by applying these methods to the selection of coffee and cocoa shrubs. Of the former the Liberian species is cultivated ; of the latter the " Forastero " variety ; both are characterised by great variability which offers a wide field of study in selection. For example, the author gives the following data collected by Folmer (Jagtlust coffee plantation). From seeds of Liberia-K5, characterised by the shape of its berry (oblong and not globular), 80 plants were raised not one of which had this character. Moreover, very great divergence was noted regarding the yield and quality of the produce. Thus in 27 plants examined, the yield varied between 8 kg., and 11.6 kg. and the weight of 100 berries varied between 24.9 gm. and 39.1 gm. On the other hand, taking the plants individually, it was noticed that good yielding plants maintained their superiority from year to year over less productive plants, as is indicated in Table I which relates to the cocoa plant.

There are therefore noticeable and constant differences between the shrubs so far as yield is concerned. Hence the opportunity and the possibility of determining the best shrubs which should furnish grafts for the progressive improvement of the plantations.

Coffee shrubs. — For each plant the following points were considered : — (1) The weight (kg) of berries produced ; (2) the weight (kg) of marketable produce (obtained by exposing the harvested berries to temperatures of 60°-70° C. for 1 or 2 weeks) ; (3) the yield, that is to say the quantity of marketable produce expressed by the percentage of the crude

produce; (4) the weight in grammes of 1000 berries; (5) the age of the bearing plant.

TABLE I. — *Productivity of cocoa shrubs: number of pods per tree in* 1917 *and* 1918.

Number of the shrubs	1917	1918	Total for 1917 and 1918
C_1	232 pods	198 pods	430 pods
C_2	116	86	202
C_3	221	145	366
C_4	169	141	310
C_5	205	41	246
C_6	159	26	185
C_7	118	25	143
C_8	100	27	127
C_9	297	227	524
C_{10}	352	218	570

In 4 different plantations (Jagtlust, Wederzorg, Geijersflijt, Guin, Vriendsch), the author had studied 28 bearing plants, from which he selected the 13 plants noted in Table II, which were considered to be the best.

TABLE II. — *Productivity of coffee shrubs: yield of the* 13 *best bearing shrubs.*

Name of the plantation and numbers of the shrubs	Weight of seeds per shrub	Quantites of merchantable produce per shrub	Yield	Weight of 1000 seeds	Age of the bearing shrub
	kg.	kg.	%	mg.	year
Jagtlust K_4	7.6	0.8	11.2	277	13
» K_5	63.0	5 5	8.8	307	»
» K_8	88.1	7.4	8.4	331	»
» K_9	102.6	11.0	10.7	244	»
» K_{10}	76.7	7.3	9 5	229	»
« K_{11}	33.4	4.1	12.2	454	»
Werderzorg K_2	23.7	2.5	10.6	254	8
» K_4	26.3	2.2	8.3	248	»
Geijersblist K_1	134.0	11 0	8.2	235	25
» K_4	120.5	11.7	9 7	299	»
Guineesche Vriendschap K_3	10.9	1.2	10.9	306	5
» » K_6	13.4	1.6	11.9	249	»
» » K_8	17.1	1.6	9 2	207	»

COCOA SHRUBS. — In selecting the bearing shrubs the following data were considered: — (1) Number of pods; (2) weight (kg) of marketable produce (seeds dried at 60°-70° C.); (3) weight (kg) of merchant produce from 100 pods; (4) weight (g) of 100 seeds; (5) age of the bearing plant; (6) size of the shrub (1 = large, well developed; 2 = medium, or small).

85 cocoa shrubs were examined in 19 plantations ; the 15 indicated in Table III were chosen as bearing plants.

In choosing the bearing shrubs, besides the total amount of the crop, the yield and the weight of the seeds, other characters, such as for example, resistance to diseases, etc. should be taken into consideration. Thus, in Culturtuin plantation the shrub C6 giving a low yield (3.7 kg. of marketable produce) was selected because of its resistance to the disease called " krulloten ", caused by *Marasmius perniciosus*. Its immunity was confirmed by artificial infection tests.

TABLE III. — *Productivity of cocoa shrubs : yield of the 15 best bearing shrubs.*

Name of the plantation and numbers of the shrubs	Number of pods per plant	Weight of marketable produce per plant	Weight of marketable produce per 100 pods	Weight of 100 seeds	Age of the bearing shrub	Size of the shrubs
		kg.	kg.	gm.	year	
Berlijn C_3	153	5.0	3.3	117	20	2
Cultuurtuin C_7	80	3.7	4.6	160	13	2
Geyersvlijt C_3	189	8.9	4.7	144	45	1
C_5	169	7.1	4.2	111	45	1
C_6	278	7.8	2.8	125	45	1
La Liberté C_3	181	6.0	3.3	112	—	2
C_4	155	6.3	4.1	112	—	1
't Lotland C_1	214	6.6	3.1	114	40	1
Pieterszorg C_1	134	6.2	4.6	138	25	1
Sorgvliet C_{12}	148	5.2	3.5	115	18	2
C_{14}	156	5.8	3.7	109	18	2
C_{16}	222	9.3	4.2	120	18	1
C_{17}	169	7.1	4.2	104	35	1
C_{19}	199	7.6	3.8	119	35	1
Susannadaal C_1	244	13.7	5.6	125	45	2

The author proposes to continue the work of selection with the object of separating the best shrubs, which will then be used as grafts and thus continue the progressive renewal of the plantations.

36 – **" Connecticut Havana No. 38," a New Variety of Tobacco Produced in the United States by crossing Two Types (No. 26 and No. 27), obtained by Mutation from the Variety Connecticut Havana.** — JOHNSON, JAMES, in *The Journal of Heredity*, Vol. V, No, 6, pp. 281-288, 3 fig. Washington, June, 1919.

The two types of tobacco " Selection N°. 26 " and " Selection N°. 27 " probably originated by mutation from the variety Connecticut Havana at the Wiconsin Agricultural Experiment Station (1919).

No. 26 is superior to the original variety in the size of its leaves and inferior to it in their number ; on the other hand No. 27 has more leaves than Connecticut Havana, but the leaves are rather small.

There was evidently a chance of uniting in a single plant the positive characters of No. 26 and 27, by eliminating the negative characters. The

cross 26 ♀ = 27 ♂ made in 1909, gave in 1910, in the F_1 generation, a plant which very closely approached the desired type and which was distinguished by the number 38. In F_2 and following generations, this plant reproduced in conformity to the type without apparently presenting the Mendelian division of 3 groups of intermediate plants, plants resembling the male parent and plants resembling the female parent. This phenomenon may be explained in two ways : —

(1) The 3 groups of pure plants differ in anatomic and histologic values which cannot be demonstrated easily.

(2) All the F_2 hybrids are identical, since commencing with F_2 the differential factors are fused in the zygote (heterozygote) so as to constitute a single new factor. This is called " blended or blending inheritance ". However it may be, the fact, independently of the explanation of the causes, remains substantially the same : the hybrids 26 × 27 are for practical purposes fixed.

After 4 years of comparative tests and control, type N°. 38 was widely distributed to growers in 1916, and the results obtained confirm the expectations; this new tobacco may therefore be recommended for all parts of Wisconsin.

Without differing too greatly from the best local varieties, No. 38 is distinguished by the following characters : —

(1) Erect leaves, which makes it occupy less space and facilitates field work.

(2) The leaves are almost uniform in size from the top to the bottom of the plant and they are broader than the leaves of Connecticut Havana.

(3) Its leaves are larger than those of Connecticut Havana, and they are also more numerous (on the average 1 or 2 more per plant).

(4) In yield it is 7 to 10 % better than the original variety.

The following table, which sums up the data obtained and gives the averages of 8 years, enables a comparison to be made of the characters of Connecticut Havana (No. 33) and No. 26-27-28 (= 26 × 27), respectively.

	Number of leaves	Size of the leaves (Average of bottom, middle and top leaves)		Breadth index of leaf
		Length, inches	Width, inches	
No. 26	14.2	20.0	11.3	56.5
No. 27	18.0	18.0	9.6	53.6
No. 38	16.9	19.1	10.6	55.8
No. 33	15.5	18.2	9.8	53.8

The value of the new type is also shown by the rapid manner in which its cultivation has spread. It was estimated that 10 000 acres would be sown with it in 1919 out of a total of 40 000 to 45 000 acres under tobacco in the State of Wisconsin.

37 - **Vigorous Growth Compensating for Sterility in Hybrids of Species of Foxglove (*Digitalis purpurea* and *D. lutea*).** — BLARINGHEM, L., in *Comptes rendus de l'Académie des Sciences* Vol. 169, No. 10, pp. 481-483. Paris, 8 Sept., 1919.

Crosses between species, which produce mixed sterile plants, often lead, by a sort of organic compensation, to the excessive development of roots, stems, leaves and flowers.

The author has studied, from this standpoint, the direct hybrid *Digitalis purpurea* × *D. lutea* and the reciprocal hybrid *D. lutea* × *D. purpurea* obtained in 1909 from the same plants, taken alternately as male and female parent, at the laboratory of plant physics at Meudon.

Owing to the absolute sterility of the ovaries and stamens of the hybrids, the two crosses produced only a first generation consisting of 120 plants, which exhibited several interesting peculiarities : —

(1) The whole collection of hybrids, direct and reciprocal, is remarkable for its homogeneity for the uniformity of growth of the individual plants. NAUDIN'S law regarding the uniformity of hybrids of the first generation is remarkably illustrated in this case.

(2) Differences of origin, well shown in the opened flowers are not indicated by any striking peculiarity in the vegetative organs. As the differences bear only on the floral and deciduous organs, the law of equivalence of direct and reciprocal hybrids, enunciated by NAUDIN for a large number of fertile hybrids, is partially applicable to these sterile hybrids.

(3) The hybrids of the species *D. purpurea* and *D. lutea* have giant and infantile characters. The continual production of shoots in hybrid root stocks which spread in tufts enabling them to be rapidly multipled by division, and the almost indefinite production of flowers on the flowering stalks which do not die, but dry up in the August sun, are proofs that the tissues of hybrids remaini n an infantile state. The author has previously brought to notice a similar example (*Specific value of various groups of wheat* [*Triticum*]. Memoir of the Laboratory of Agricultural Biology at the Pasteur Institute, 1914, p. 44) in the almost sterile hybrid *Triticum monococcum* × *T. durum*, and has shown that the tissues in that case remained in an state characteristic of the infancy of one of the progenitors.

(4) At the end of July, 1919, almost all the stalks developed in the hybrids showed well marked characters of fascies.

To sum up, hybridisation between species of foxglove, which entails sterility, causes excessive growth of vegetative tissue with all the characters which belong to young well nourished organs.

38 - **Origin, Production and Value of the Seeds of Conifers.** — PICCIOLI, L. (Professor of sylviculture, alpiculture, and technology, at the Royal Forestry Institute of Florence), in Extract from *Annali del R. Istituto superiore forestale nazionale*, Vol. IV-V, pp 185, 190, fig. bibliography. Florence, 1920. AGRICULTURAL SEEDS

Monograph on the seeds of conifers containing the following chapters : Importance of heredity of mutations. — Effects of origin — Prohibition of exportation. — Private, commercial, and State production — Importance of the choice of trees for the quality of seeds. — Periodicity of abundant seedings, and causes which determine them. — Collection of fruit. —

Extraction of seeds from their cones. — Sorting. — Volume, weight and production, per unit of fruits and seeds. — Fertility, lasting power, and preservation of seeds. — Frauds, and the utility of a control station — Morphological characters for recognising seeds.

This last chapter, which contains numerous data, may be useful referred to in the work of control of seeds.

The publication ends with a long bibliography.

39 - **Fumigation of Seeds by Means of Chloropicrin.** — See No. 68 of this *Review* note (1).

STARCH CROPS

40 - **Experiments in the Cultivation of Various Kinds of Potatoes from the Canary Islands.** — Bois, D. in *Bulletin de la Société Nationale d'acclimatation de France* Year LXVII, No. 9, pp. 273-280 2 figs. Paris, Sept., 1919.

Results of experiments in the cultivation of potatoes from the Canary Isands announced by the author in a preceeding article (1).

A. Experiments in 1918 at the Paris Museum. — Planting took place on May 10, in light soil, manured the preceeding autumn; harvest on November 5.

(1) "Papa palmera", 5 plants. Total crop: 51 tubers weighing altogether 3.528 kg. or on an average 720 gm. per plant; violet skin, yellow flesh, average quality fairly good.

(2) "Papa blanca" 5 plants. Total crop: 55 tubers = 1.406 kg., or 281 gm, per plant, therefore a crop very inferior to that of the preceeding variety. Colour uniform yellowish-white, pale yellow flesh, fine starch, very good quality.

(3) "Papa negra" 2 plants only, 2 tubers not having sprouted. Total crop: 11 tubers × 700 gm., that is 63.65 gm. per tuber and 350 gm. per plant. Shape irregular, colour violet pink, yellow flesh, no information regarding the quality.

The two other varieties, "Papa melona" and "Papa de Baya", were received too late to be planted (end of June, 1918).

B. Experiments in Algeria, Tunis and Morocco. — The results are not yet known. It is interesting to note that the varieties of Canary Island potatoes are suited, if not to a tropical climate, at least to a subtropical one. They would therefore be valuable if this suitability allowed of their cultivation in those colonies where European varieties do not succeed, or give only poor results. This can only be learnt by experiment.

C. Experiments in 1919 at the Paris Museum. — The "Papa palmera" variety has given a fairly high yield but its irregular shaped tuber, and its medium quality are fairly grave defects; it would only be really interesting if fresh trials, in a more favourable season, showed that it was a good cropper and if its quality was improved, by cultivation in a more suitable soil. The "blanca" variety produced fewer tubers, which were, however, much more regular and of good quality.

(1) See *R.*, Feb. 1919, No. 194. (*Ed.*)

41 – **The Cultivation of Cotton in Australia.** — *The Board of Trade Journal*, Vol. CIII, 1194, p. 485. London, Oct. 6, 1919. FIBRE CROPS

The possibility of permanently establishing the cotton-growing industry in Australia will probably be thoroughly tested in the near future. Efforts to establish the cotton-growing industry in Queensland on a successful footing, however, have not hitherto met with much success.

There was a brief period when, as a result of the American Civil War, Queensland exported 26 000 000 lb. of ginned cotton, valued at £1 300 000, but by 1914 the area under cotton had shrunk to 214 acres, the yield to 35 230 lb. of unginned cotton, and its value to £881.

Despite this discouragement the opinion is held that there are few, if any, difficulties in the way of extensive cotton growing in Australia, particularly in the province named and in the Northern Territory and Western Australia, where both soil and climate appear excellently suitable.

In reply to the assertion that the yield of cotton in Australia, as shown by statistics, indicated inferior conditions or methods, it has been stated that Queensland obtained a much larger yield per acre than can be obtained in the United States of America, and that natural conditions in Queensland would more than compensate for higher cost of labour than in other countries.

The Commonwealth Government has endeavoured to encourage the industry by offering a bounty of 10 per cent. on the market value of cotton grown, and ginned in Australia, but only £21 had to be paid out in 1914. The high prices reached in the cotton markets during the war led to extended cultivation, and the Queensland Department of Agriculture Ginnery received 166 000 lb. of cotton in 1918, as compared with 9 500 lb. in 1914.

The high cost of hand-picking seems to be the chief obstacle in the way of the industry's establishment on a large scale. This is partly due to the higher wages paid in Australia than in the other cotton-growing countries, but it is thought that the difficulty could be overcome by encouraging farmers to grow, say, not more than about 10 acres of cotton, in addition to other crops, so that a family of four could easily pick the cotton without outside help. Inexperience, and the lack of skilled pickers too, play a part in running up costs. The introduction of an efficient mechanical picker would help materially towards putting the industry on a successful footing, though mechanical picking would necessarily be restricted to the varieties of cotton in which the calyx opens wide and the seeds are relatively loose.

As regards quality that of Queensland cotton is stated to be very high. The Commonwealth's imports of cotton piece-goods in 1913 exceeded £3 000 000 in value (duty free from the United Kingdom, and 5 per cent. tariff from other countries). Australia has no cotton-manufacturing industries at present.

The Commonwealth Board of Trade does not consider present prospects of materially increasing cotton production very promising, and enquiries in the United States of America have led to the opinion that the discovery

of a mechanical picker for good crop cotton is unlikely, in view of the fact that selection by eye of the riper pods is a necessary factor. At the same time, Australia has its parallels as regards soil and climate in many of the cotton-growing districts of the United States of America, and, under similar conditions, the same types of cotton (there are some 200 different varieties) could probably be cultivated successfully in many parts of Australia.

The experts of the American Bureau of Plant Industry have advised the Board that before the cotton-growing industry can be successfully established in Australia, experiments will have to be made in exactly the same way as has been done with wheat growing and wool production.

42 - **Cotton in the French Settlements of Oceania.** — *Bulletin de l'Office colonial*, Year XII, No. 135, pp. 190 191. Melun, 1919.

Owing to the scarcity and dearness of labour, the cultivation of the cotton plant is being more and more abandoned in the French settlements in Oceania; and production has continually decreased during the last ten years as is shown by the figures below, regarding exportation from 1910 to 1917.

Year	Weight	Value	Year	Weight	Value
1910	78 276 kg.	97 599 fr.	1914	17 320 kg.	28 673 fr.
1911	27 536	42 047	1915	8 485	11 115
1912	31 977	55 586	1916	10 565	18 522
1913	26 700	46 104	1917	4 112	18 224

43 - **Fibre Plants and Products, and Textiles of Indo-China: Cotton Plant.** — CREVOST, CH. and LEMARIÉ, CH., in *Bulletin économique de l'Indochine*, Year XXI, New Ser, No 136, pp. 365-401, 3 plates, 1 fig. Hanoï-Haïphong, May-June, 1919.

This article is the continuation of the first volume of the *Catalogue des Produits de l'Indochine* by the same authors (1) and will form the 1st part of the 2nd volume of that publication.

In the *Flore générale de l'Indochine*, M. GAGNEPAIN notes 4 species of cotton-plant, distributed in the native crops of the different countries of the Union: —

(1) *Gossypium indicum* Lamk., grown in Tonkin, and Cochin-China; short staple, very adherent to the seed.

(2) *G. arboreum* Lin., grown in Siam and Cambodia.

(3) *G. hirsutum* Lin., cultivated in CochinChina and probably also in Cambodia; fibre very adherent to the seeds, rarely longer than 25 to 27 mm., of excellent quality.

(4) *G. vitifolium* Lamk, with the varieties *acuminatum* and *tricuspidatum*, cultivated in Cochin-China, in Cambodia and Laos.; cotton slightly adherent, of excellent quality.

Attempts to introduce foreign varieties (American, Egyptian) have only given poor results. It is thus easier and more profitable to improve local kinds which have been tried for a long time. Cambodian cottons are parti-

(1) *Catalogue des Produits de l'Indochine*, Vol. I. *Produits alimentaires et Plantes fourragères*, by CH. CREVOST and CH. LEMARIÉ, Imprimerie d'Extrême-Orient, Hanoï, Tonkin (*Ed*).

cularly esteemed in Japan. The communication made on this subject, at the Colonial Agricultural Congress at Paris, in 1918, by M. MARTIN DE FLACOURT, head of the agricultural and commercial services of Cambodia, showed the efficiency of the method (1).

The valley of the Mékong offers many sites and lands, which are suitable to a profitable cultivation of cotton. The mountainous lands of Tonkin and the plains of Thannh-hoa, where, however, this textile has been produced on a large scale from time immemorial, are doubt less less favourable, but it is certain that the irrigation undertaken by the "Services d'hydraulique agricole", in the provinces of Thannh-hoa and elsewhere (2) will favour a crop, contrived so as to obtain maturity in the dry season.

The growth of the plant requires, from planting to harvest, 4 to 6 months, according to locality. It is therefore possible, at least for countries with a regular dry season, to find a favourable time for sowing. Fertility, and especially a suitable proportion of humus, are very frequently lacking in the soils which the Annamites devote to the cotton plant. Experimental cultivation has shown that "sideration" allows of a rapid improvement, in a soil reputed unsuitable to that crop., and of bringing it to bear fine crops. Preference should be given to leguminous plants such as the soya bean, mungo pea, "voehms", and more especially, the "Tonkin bean". Many other native leguminous shrubs are available to planters.

There is much to be done to increase the yield of the cotton plant in Indo-China.

While in India the annual production of similar varieties may reach 165 kg. of cotton per ha. it averages 123 kg. at Thanh-hoa, in Cambodia it does not exceed 125 kg. in alluvial soils, but recent cultivation in red soils in the Kratié, district with selected seed, gave 218 kg. per ha.

In Cambodia, trials undertaken by M. MARTIN DE FLACOURT are most interesting. Giving up inundated land, he turned his attention to high land, where he has obtained excellent results, by altering the sowing season, so that the cotton plants reach maturity in the dry season.

Commercial examination has graded these cottons above similar kinds from Africa, comparing them to Good Middling American 28-29 mm.

Laos cottons sometimes. have an unusually long staple; unfortunately this country is not yet open to colonisation, for lack of suitable means of communication.

In Tonkin the cultivation of the cotton plant is of slight importance. In mountainous districts the variety "Bong-ro" has a remarkably long staple.

In Annam, the cotton plant is scattered over the whole country, without being anywhere cultivated on a large scale.

(1) See *R.*, Dec. 1918. No. 1555. (*Ed.*)

(2) As regards agricultural irrigation in Indo-China see (1) *L'hydraulique agricole en Indochine* by L. COSTANTIN, Paris, Congress of Colonial Agriculture, 1918, Hanoï Series, No 15, Hanoï 1918. (2) *Travaux secondaires d'hydraulique agricole en Cochinchine* by J. ROBIN, Paris, Congress of Colonial Agriculture, 1918, Saigon Series, 1918. (*Ed.*)

In Cochin-China it is only in the province of Baria that regular cultivation of cotton is found.

The introduction of hand-ginning machines among the natives has not been crowned with success. Of the different machines tried, M. MAGEN considers that the MACARTHY roller and knife system, subject to some improvements, meets the needs of Indo-China best ; up to date only Cambodia has made important exports. Before the war, from 1549 tons exported in 1911 the export had increased to 10 085 tons in 1913.

The cotton question in the Far East being of particular importance at the moment, the authors rightly think that Indo-China should not let itself be beaten by its rivals.

44 - **Cotton Production in Asiatic Russia** — *Bulletin de l'Office colonial*, Year XII, Nos. 138- 139, pp. 455-456. Paris-Melun, June-July, 1919.

In 1912, 535 000 ha. had been planted under cotton in Russian Turkistan and Transcaucasia ; they yielded about 440 000 t. In 1917, the area planted had fallen to 337 000 ha, a decrease of 37 %. In 1918, cotton plantations had again to give place to cereals in consequence of the stoppage of all importation of wheat, and fear of famine. It is, therefore, probable that the cotton fields were still less in area than those of 1917, which had not yielded 275 000 t.

Deducting the amount required for the manufacture of local cotton goods, this last figure leaves only 190 000 t for home spinning and weaving, including that of Russia in Europe. In normal times, the Russian spinning mills absorbed the normal production of the Asiatic colonies, and imported, 178 000 t. of American, Egyptian, and Persian cotton as well.

45 - **Cotton Cultivation in the Belgian Congo.** — BALLON, F., in *Bulletin de l'Association des Planteurs de caoutchouc*, Vol. VI, No. 8, pp. 12-13. Antwerp, Aug., 1919.

From the beginning of its foundation, the Congo State thought of developing cotton cultivation in is territories. But the experiments tried in Lower and Upper Congo were unfavourable. Experiments were undertaken in 1915, by M. FISHER, in the eastern province at Nyanwe farm (Maniéma), where the State owns 500 head of cattle, and has at disposal a considerable extent of light land, apparently very suitable for the crop The climate of Maniéma is more uniform and the rainfall is greater than in the Lower Congo ; labour is more abundant and better there. Experiments showed that the soil and climate of this region were very suitable for cotton cultivation.

Two varieties " Triumph " and " Simpkins ", short staple American cottons, called " Upland ", were found to be very suitable to the climate and soil of that region.

MM. FISHER and BLOMMAERT induced the natives to cultivate cotton, and they showed themselves well satisfied with the sum of money brought in by the small areas cultivated, which had given them practically no trouble.

The first Maniéma cottons reached the Liverpool market in 1916, and were in good demand. They were graded with Middling American.

Cultivation has progressed in a remarkable manner; the area plantde by the natives increased from 45 ha. in 1916 to 500 ha. in 1917, 1000 in 1918, and, apparently, about 1500 in 1919.

Other experiments were made after 1916, with success, in the two districts of Sankurn and Kasai, and for 1919, on a cultivated area of 1500 ha., a production of 600 to 700 metric tons of cotton may be expected.

Two ginning plants were bought in the United States in 1918.

A third promising region for cotton is found in the north of the colony in the Uele districts and experiments will be attempted there before long.

46 – **Yield of Sisal.** — I Watkins, in *Tropical Life*, Vol. XV, No. 3, pp. 34-35. London, March, 1919. — II. *Bulletin économique de l'Indochine*, Year XII, N. S., No. 136, p. 489. Hanoï-Haïphong, May-June, 1919.

I. — Experiments made with the object of improving the production of sisal by manuring and especially by returning to the soil the " bagasse " or pulp remaining after the extraction of the fibre (1).

With regard to the yield in dry fibre, the author states that in Yucatan the yield is commonly about 50 lb. per 1000 leaves. With certain selected leaves the yield may be as high as 100 lb. More frequently from plants of 5 to 7 years old, the most productive age, 75 lb. per 1000 leaves and half a ton to the acre are obtained. It is hoped, with improved machinery, to extract a minimum of 7 to 8 % of fibre from the leaves instead of the usual minimum of 4 to 5 %.

The author himself has found in the Caicos islands, situated to the south of the Bahamas and east of Cuba, that the average yield of dry fibre would not exceed 30 lb. to 40 lb. per 1000 leaves; the percentage would be 4 %; the yield per acre, with 1500 plants, would vary from 675 lb. to 900 lb. per annum.

These calculations are based on the fact that each plant produces, during its life time, about 15 leaves a year.

According to the author, the average number of leaves which each plant can yield annually without injury would be: — 1st cutting, 30 to 40 leaves; 2nd cutting, 10 to 15; 3rd cutting, 7 to 10.

II. — The article dealt with above is summarised and discussed in the *Bulletin Economique de l'Indochine*.

The percentage yield of fibre of green leaves is ordinarily 4 to 5 %. The difference between this percentage and the 7 to 8 % spoken of by Mr. Watkins seems too great, considering the small proportion of fibre which remains in the waste.

Some 15 leaves annually per plant seems hypothetical and difficult to realise, since the life of the agave varies between 7 and 25 years according to locality, the variety grown and the method of cutting. A yield of 30 to 40 leaves for the first cutting is likely to injure the plant.

(1) For utilisation of sisal refuse otherwise than as manure (in particular the production of alcohol), see *R.*, August, 1918, No. 904. (*Ed.*)

47 – **Cultural Experiments with Textile and Oil-bearing Plants in Sjaelland, Denmark.** — JACOBSEN, A. P., in *Beretning om Landboforenin arnes Virksomhed for Plantevalen paa Sjaelland*, 1918. pp. 543-544. Copenhagen, 1919.

Results of a series of cultural experiments, made with white mustard, sunflower, flax, and hemp, in Sjaelland (Denmark), in 1918.

WHITE MUSTARD. QUANTITY OF SEED: — Comparative experiments with 4-8-12 kg. per ha. With an increasing quantity of seed sown, the yield was also increased, and gave respectively 1031-1218-1312 kg. per ha. Manuring per ha.: — 100 kg. of superphosphate and 100 kg. of 20 % potash salt. Sowing May 22; harvest October 9.

SUNFLOWER: TIME OF SOWING: — By sowing on April 14, May 1 and 8, 1700-1050-626 kg. of seed per ha. were obtained respectively; early sowing is therefore advised.

FLAX. TIME OF SOWING: Sowing was done on the April 25, May 8 and 23; reaping took place on August 6 and 16, and on September 2, with the following results: —

1st sowing	1475 kg. of seeds	3225 kg. of stalk	900 kg. waste
2nd sowing	1225 »	3175 » »	900 » »
3rd sowing	1175 » » »	3650 » »	925 »

The first sowing gave the finest fibre, the 2nd slightly inferior results: lastly the 3rd yielded plently of fibre but of a slightly coarser quality. The later the sowing the smaller the yield of seed.

HEMP. TIME OF SOWING: By sowing on April 30, 140 kg. of seed to the ha., 168 00 kg. of stalks per ha were obtained; on the other hand, sowing later, on May 14, scarcely half that quantity, 8360 kg. was obtained.

PLANTS YELDING OILS, DYES, ANNINS, ETC.

48 – **Cultivation of Flax for the Manufacture of Linseed Oil in the United Kingdom.** — VARGAS EYRE and MORRELL, R. S., in *The Journal of the Board of Agriculture*, v. XXVI, N° 4, p. 420-428. London, July 1919.

The British Flax and Hemps Grower's Society, Ltd. has undertaken a series of investigations on the cultivation of flax for production of seed and its utilisation from technical and economic standpoints in view of the shortage of fats during the last few yearas.

Several varieties of indigenous and imported linseed was in the first place experimented with at Wye College. Table I shows the comparative values of the different types of linseed investigated.

TABLE I. — *Comparative values of types of linseed investigated.*

Type of seed	Seed Yield per acre		Percentage of oil	Oil per acre
	cwt.	lb.		cwt.
Moroccan	12	25	42,9	5.25
Dutch	11	86	37.7	4.43
La Plata	14	70	42.8	6.26
Steppe	13	53	41.5	5.60
Baltic	6	28	34.0 to 35.6	2.18

The linseed obtained compares favourably with imported linseed; in size of seed and in oil content English grown linseed is absolutely superior to imported linseed, as will be seen in Table II.

TABLE II. — *Comparative values of imported linseed and English linseed.*

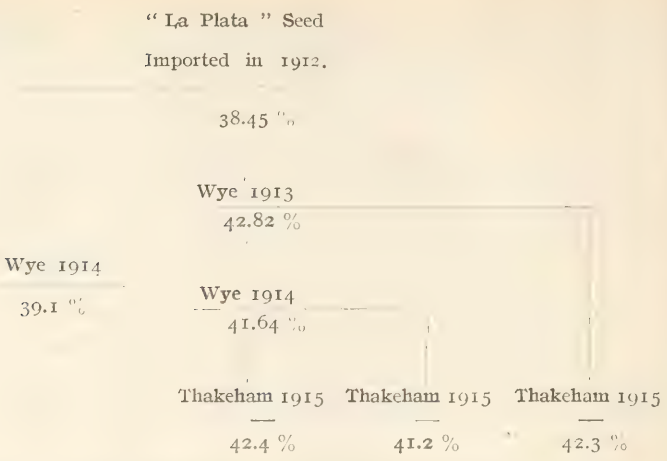
	Weight of 1000 seeds	Oil content per cent.
	gm.	
Seed of "La Plata" imported in 1913. . .	6.108	38.45
English grown linseed raised from the above imported sample on 4 different farms . . .	8.840	42.80
	9.204	39.69
	7.712	37.72
	8.744	41.35

Similar results to those in Table II were obtained in 1914 and 1915 on experimental plots in various places in England; in 1916 on 9 farms which grew "La Plata" linseed on a large scale, the results given in Table II were confirmed, as is shown in Table III.

TABLE III. — *Comparative values of imported linseed and English linseed.*

	Weight of 1000 seeds	Oil content per cent.
	gm.	
Seed of "La Plata" imported in 1916. . .	6.4210	38.8
English grown linseed obtained in quantity from the above imported seed on 9 farms	7.1602	41.5
	8.5324	40.5
	8.1771	39.7
	7.6272	42.1
	8.2201	42.4
	7.9630	41.3
	7.1055	39.4
	7.7637	39.7
	8.3570	39.8

Further, cultivation experiments with "La Plata" seed made from 1912 to 1915 have shown that the high yield of oil of this variety in England is constant and does not decrease in successive generations as is shown in the following diagram relating to the oil content of linseed grown in successive crops at Wye, in Kent and at Thakeham, in Sussex



These results prove that the value of English linseed as a source of oil is very high. If all the oil is expressed; a yield of 50 to 70 gallons of oil per acre may be expected, or; if the linseed is pressed to form a standard cake, a yield of 35 to 45 gallons on the basis of an average oil content of 40 %.

TABLE IV. — *Comparative yield in oil according to the method of pressing.*

Yield when totally expressed		Yield under pressure leaving 10 % of oil in the cake	
Cwt. of seed per acre	Gallons of oil per acre	Cwt. of seed per acre	Gallons of oil per acre
10	48	10	36
15	72	15	54
20	96	20	72

In view of the scarcity of oil the authors advise total expression and the addition to the cake of a less valuable oil or fat for cattle food. Regarding the importance of the cultivation of linseed in the rotation or in crops combinations, the authors instance the heavy crops of wheat obtained following linseed on clay soil and on newly ploughed pasture land, and conclude therefrom that the cultivation of this industrial crop can indirectly render remarkable service to English agriculture.

Regarding the cost of cultivation, the data collected by the above-mentioned Society indicate that, in a large number of cases, the average cost is £8.10 *s.* per acre ; in any case the figure should not exceed £10 per acre.

At the present price of £45 per ton, the average gross return per acre would be £33.15 *s.*, without taking account of the straw or the chaff. The

yield of straw varies from 9 to 21 cwt. per acre according to the fertility of the soil, its tilling and its manuring. The present price of the straw in bales is from £4 to £5 per ton. There is, in addition, about 7 ½ cwt. of chaff per acre selling at £5 per ton. The straw and chaff thus and £5 per acre to the gross return, brings the total up to £39 per acre.

THE COMMERCIAL VALUE OF THE LINSEED OIL PRODUCED. — The examination of the oil produced during the experiments has extended over the crops of 3 years : a small quantity in 1915, half a ton in 1916 and 3 tons in 1917. The properties of these oils are similar to those of superior-quality Baltic oils.

If the quality of the seed is maintained, linseed oil made from English —grown seed will always fetch the highest market rate. The superiority of the quality will easily out-weigh the disadvantage arising from the higher cost of production. The characteristic properties of Baltic linseed oil causes it to be in special demand with makers of high grade paints and oil colours. The high quality of the product examined warrants the prediction that English manufactures will be independent of linseed oil from Russia. The cake produced for cattle food is equal to the best at present on the market.

CONCLUSION. — England is in a position to produce a considerable quantity of linseed oil of superior quality.

49 - **On the Utilisation of " Sump ". (*Balanites aegyptiaca* Del).** — AMMANN PAUL in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Ser., Year IV, No. 16, pp. 42-45. Paris, Sept.-Oct., 1919.

Balanites aegyptiaca, a tree 16 to 20 ft. in height, grows in a certain number of semi-desert regions of tropical North Africa, as well as in India and Burma. It is fairly widespread in Senegal, where it is called by the name of " sump " (in Onolof language). Its usual habitat is always far from land constantly submerged by water ; it forms woods, whose density varies from 30 to 50 trees per hectare.

The tree is very hardy and coppices well ; it bears green branches, covered with long green spines.

The wood of " sump " burns almost without smoke, and is used as fuel. It is also used for making various utensils (mortars, pestles, handles of tools, etc.)

In the region of the Senegal river flowering commences in May - June ; the fruits, formed in July, are ripe in September-October, but can still be gathered from December to February. Externally, they have a slight resemblance to the date. Their sweet deep red pulp is eaten by man and animals ; macerated in water, it gives a refreshing and slightly acidulated drink. The natives extract edible oil from the kernel, from which they also sometimes make soap.

As it is possible, beyond the needs of the natives, to procure 5000 to 6000 tons of " sump " fruit per year from Senegal, the government of this colony has made an inquiry as to the possible industrial value of this raw material.

The writer gives a complète analysis of the fruit. The kernel contains 41.80 % of fats, which is a very interesting proportion. But if the whole fruit is taken into account, the proportion of oil falls to 3.68 %, and, in proportion to the stone, not more than 7.63 %. It is therefore absolutely impossible to think of transporting the fruits or even the stones of " sump ", in order to treat them in Europe. The kernel alone might pay for its carriage, but it is difficult to extract it from its hard and elastic covering. Besides, the kernel breaks and crushes easily and would require for this reason, special precautions in packing.

The pulp can produce 9.7 to 10.8 cc., of alcohol per 100 ; the value of the alcohol would not be sufficient to be worth exporting the whole fruit.

The fruit of " sump " at present, therefore, have no interest, except for local needs in regions where the tree grows wild, and where it could be worked in a very extensive manner by the natives.

RUBBER, GUM AND RESIN PLANTS

50 – **Notes on the Cultivation and Working of *Hevea* in Cochin-China** (1). — GIRARD, E. (Administrateur-délégué des Plantations de Suzannah et Au-Lộc, Président p. i. du Syndicat des Planteurs de Caoutchouc de l'Indochine), in *Bulletin Agricole de l'Institut Scientifique de Saïgon*, Year I, No. 10, pp. 289-299. Saïgon, Oct., 1919.

GENERAL REMARKS. — The author recalls that in previous notes (2), he endeavoured to show the great advantage of intensive cultivation of Hevea with ploughing and manuring of the plantations, the importance of the task of the tappers and the relation of that task to the spacing of the trees, the different advantages of wide spaced plantations — advantages which he recommended at the time when he applied the system over very large areas; from 200 trees per ha. in his plantations of 1909, 1910 and 1911, passing to 100 in 1913, and, in 1915, he made very wide spaced plantation with coffee cultivated between the trees, 30 Hevea trees per ha. planted 18 × 18 metres (2).

The note under review is intended to persuade planters to adopt indispensable modifications in their methods of working or, at least, to commence at once experiments on the lines indicated.

WORKING. — It is generally admitted that the girths of Hevea trunks at 1 m. from the ground ought, under good conditions, to increase by 10 cm. per year, and apparently it is still held that the trees can be usefully tapped at the arbitrarily fixed size and age of 40-50 cm. girths and 5 years. This increase in girth varies generally from 2 or 3 cm. to 20 cm., according to age, spacing and many other factors which influence the growth.

It is, however, evident that the profit from tapping, always variable, is bound by various factors, components of the cost price of rubber; — market price of rubber; freight; production, taking into account the using up of the bark, for all production obtained by means

(1) This paper forms the seventh part of the general article on *Hevea in Indo-China*, published in this *Review*, Feb. 1919, No. 205, p. 183 (*Ed.*)

(2) For these questions, especially those of spacing and growing crops between the trees see *R.* Feb. 1919, No. 205, II and VI. (*Ed.*)

of excessive tapping can only be reckoned to the extent to which it compensates for all the consequences of that abnormal using up of the bark; capital invested, in relation to the possibilities of profit calculated after liberally providing for the amortisation of the plantations.

The importance of some of these factors is so great that the writer enlarges on certain points.

Relation between the production of rubber and the destruction of the bark. — The yield of rubber is directly influenced by the extent, frequency, and depth of tapping. But the surface of bark which can be worked in practice and its power of renewal are limited, while the power of elaborating latex is limited. The yield ought therefore to be kept within limits corresponding with normal tapping, so as to allow complete renewal of the bark and the preservation of the tree in full vigour. It would therefore be logical, when intensive tapping is practised, to deduct fully the amount of the enormous damage which results from the production obtained to the detriment of the capital represented by the trees thus rapidly exhausted.

Instructions for estimating the exhaustion due to intensive tapping. — Mistakes have been often made regarding the time required for renewing the bark (1).

The time required for the regrowth of the bark cut away is very variable and is longer when tapping has been intensive and was commenced when the trees were young. The fertility of the soil, spacing of the trees and care taken in cultivation, manuring, as well as correcting accidental deformations have, on the other hand, always helped and hastened renewal. Furthermore, the author thinks that it is certain that when the bark is cut away carefully and to a moderate extent, especially in the depth of the cut, it can reconstitute itself integrally in thickness, even on trees which are tapped daily. This result was obtained in 7 years in a plantation on fertile soil on trees that were well cared for, manured twice during that period and completely tapped on 1/5 of the girth in the following proportions: — On 3 notches one above the other during the first two years; on 2 notches one above the other and on a single notch during the 5 following years.

The author's experiments have shown that, for daily tapping, not deep and well done, with 2 notches on 1.5 of the girth, the average time required for complete renewal of the bark was 7 years, on fertile cultivated soil. But the author has noticed a more rapid renewal during the early years on trees tapped with one notch on $^1/_5$ of the girth for 160 to 170 days only in the year, than indicated above for trees tapped every day. Other

(1) It is usual in plantations, with all systems of tapping, to calculate the space between the cuts so that the same part is not cut a second time within 2 years in young trees and 4 years in older trees.

Tapping, as practised in plantations, is particularly well described in *La Culture de L'Hévéa, Manuel du Planteur*, by Dr. P. J. S. Cramer, translated from the Dutch and with a preface by Dr. E. de Wildeman, 1 vol. pp. 132, 40 fig., S. H. de Bussy, Rokin 60/62, Amsterdam, and A. Challamel, 17, Rue Jacob, Paris, 1911. (*Ed.*)

Hevea trees tapped from 110 to 120 days in the year, with alternate periods of tapping and rest, have shown a still more active renewal of the bark during the first year of the experiment (now in progress).

If the Hevea trees are rationally worked, but only on that condition, it should be possible to tap them for many years, working always on bark of full thickness and with entirely renewed latex vessels.

Influence of tapping on the duration of Hevea trees. — It would be unwise to fix a duration of tapping applicable in all cases, which evidently cannot be identical. But it is possible to lay down the principle that the more intensive the tapping the shorter will be the period of successful working of a plantation (it being, of course, understood that the tapping, whether moderate or intensive, is always practised in such a way as to avoid wounds and leaving beneath the bark cut away a sufficient thickness, at leat 1 mm., to assure good renewal.

The economy of bark realised by working moderately is fortunately complementary to that which is realised by avoiding the tapping of young immature trees which scarcely pays even if it does not cost more than it produces.

Too deep tapping, especially in a dry season, causes the partial drying up of the remaining laticiferous vessels, which are insufficiently protected, from which, as the result of cracks caused by the growth of the trunk, arise brown streaks sometimes assumed to be a fungous disease. They also cause swellings on the trees, with nodules on the tapped surface, which many planters assume are infections due to the tapping knife (whence the common expressions, nodular canker, and streaked canker, etc.).

Almost all deformations which check the circulation of latex and lead to drying, followed by destruction of the bark, can be avoided by careful and moderate tapping. From an economic standpoint, with intensive working, which requires a rapid amortization, plantations should be taken at their actual value at the time when tapping commences to "use them up" while there is every advantage in making them last and preserving them in full vigour.

All plantations in which trees interfere with each other before they have reached a state of development corresponding to a really remunerative tapping, should be rapidly thinned.

Plantations tapped late and moderately, yield much more rubber per ha. during the early years of working, than those where highly intensive methods are commenced at an earlier age and before the trees are completely developed. In the former case a sustained higher annual yield would be obtained and most probably the quality of the rubber would be better. At least, in similar conditions, the older the plantations are and the more vigorous and sound the bark of the trees, the higher will be their yield. For the last 10 years of the author's experiments the difference in the yield of trees tapped later and sparingly, taking an equal tapping period, may amount to over 1000 kg. of rubber per ha.

Basing his calculations on investigations made on trees of equal age, tapped after an interval of 2 years, the author found, taking rubber at 5 fr.

per kg. a difference, corresponding with the increased production noted, of 4000 fr. per ha for a period of 10 years, or 450 fr. per ha. per year in favour of the Hevea trees on which tapping began at 8 years instead of 6.

The author recommends, whenever remunerative conditions of working are realised, the tapping of trees with a density of 200 to the ha. at the age of 7 or 8 years, with a minimum girth of 60 cm and an average girth of 70 to 75 cm. at 1 m. from the ground.

The duration of profitable working, so often reduced to a few years in the case of the usual intensive tapping, could be prolonged considerably in the case of later and more moderate tapping, for the Hevea tree kept in a vigorous state can live very long, 100 years or more according to observations made in the Amazon forests.

Choice of a tapping method. — The method of tapping Hevea trees, like the fixing of the time for commencing working, should correspond with technical and financial conditions which should not be lost sight of. The author, a priori, negatives intensive tapping as its disadvantages are too great. The examination of the latex — a subject previously dealt with by M. Vernet in 1905 in his paper "*L'Hevea brasiliensis*" (No 44 of the *Bulletin économique de l'Indochine*) — should enable all planters to know that multiple tappings are excessive, as are all those which involve more than 1/5 of the girth of the tree in a single notch, if they are made daily.

The percentage of dry rubber in the latex of normal Hevea trees, which is 50 % or more when tapping is commenced — both in young and old trees — may decrease to 25 % in the case of intensive tapping. This weakening of the strength of the latex is proportional to the extent and frequency of tapping and is the cause of most of the bark diseases ; the author is convinced that this state of the latex precedes total exhaustion of the trees. Furthermore, the author is certain that the great complaint of want of uniformity in the quality, with which plantation rubber is justly charged, arises from the great variation in the strength of the latex treated, variations which must entail other modifications of very great importance in the value of the product. The quality of Para rubber depends much more on the method of tapping, reduced to 2 months a year at most for each tree and yielding, owing to this moderation, a complete latex, than to the coagulation method whose chief advantage lies in the total preservation of the constituent elements of the latex, coagulated much more by evaporation by heating than by contact with the smoke. All these conditions which, according to the author, give Para rubber its superior quality, may henceforth be easily realised in plantations (1).

The argument of quality is added to those dealt with above in favour of moderate tapping whose practical form, ideal from all standpoints, is *alternation*, which the author, will deal with specially in detail in a forth-

(1) From the industrial standpoint, for obtaining a plantation rubber of uniform character comparable with Para, an interesting process has been recorded, the process of Maude and Crosse. See *R.*, March 1919, No. 368. (*Ed.*)

coming paper. Meanwhile he advises fortnightly or monthly alternation, the latter especially.

(1) *Fortnightly alternation.* — Two groups of trees per tapper, tapped and resting alternately for 15 consecutive days, a single notch on 1/3 of the girth on a band 60 cm. wide lasting 2 years. If this bark is cut away too soon take 90 cm. for 3 years.

(2) *Monthly alternation.* — Has the advantage of allowing Sunday rest with a yield equal to that of fortnightly alternation. This equality of yield in fewer days tapping — about 25 or 26 days out of 60 with monthly alternation, instead of 3 out of 60 with fortnightly alternation — is explained by the suppression of one of the tapping turns which causes a decrease in the yield during several days. This slowing of the flow of latex is due, in part, to its thickening and to the acidity of the healed bark.

The trees are tapped every day, except Sundays, for a month, and then completely rested for a month. As in the case of fortnightly alternation, the tapper looks after 2 groups of trees.

By giving the trees a rest of 1, 2 or sometimes 3 months according to the weather and the condition of the soil, when the leaves are being renewed, in addition to the periodical suspension rest of alternation and to stoppages caused by morning rain (2), tapping is reduced : — (1) to 105 days in the case of 3 months rest, with about 13 wet days ; (2) to 135 days if the period of rest is only one month with a similar number of wet days.

The author thinks that the strenght of the latex should never be allowed to fall below 35 %, if the bark is to be renewed properly and the trees are to remain vigorous. Ten kg of pure latex should therefore yield at least 3.500 kg. of dry rubber at the end of the selected period of alternation. Perhaps it would be advantageous for uniformity of the quality of the rubber not to reach so low a limit. Possibly, on the other hand, it would be advantageous for the yield, without causing much damage, if the strength was as low as 32 or 33 %. But it is dangerous for the health of the trees and bad for the quality of the rubber to let the strength go, even temporarily, as low as 30 %. Below this percentage diseases or signs of decay appear. Above 45 % the flow of latex is too slow to allow of a sufficient yield.

Testing the strength of latex on plantations. — Weigh a fair amount of latex, say 10 kg., quite pure, taken from any part of the lot to be tested. Coagulate this amount separately, by the method used on the plantation, weigh the rubber as it comes from the "mangle" so as to

(2) It is well known that tapping should be done before noon — for, during the afternoon the trees transpire freely and the latex does not flow well — and is not practicable on days when heavy rain falls in the morning, because the rain water running down the trunk would wash away the latex. The latex flows best when tapping is done after night rain, but it is then very thin. A well distributed rainfall throughout the year is one of the characteristics of the climate of the Malay peninsula ; wet mornings are not very important in the Malay peninsula but they may be so in other regions (Ceylon, Indo-China, etc.). Dr. Cramer's work, previously referred to, may usefully be consulted on this subject. (*Ed*).

get a approximate result. After complete drying the weight gives the yield in dry rubber. When the latex brought in to the factory is uniformly pure, this test made every day for all groups of trees — the number of groups should not be too great — should enable all essential points in the tapping to be controlled and a uniform product, in as large a quantity as possible without causing abnormal exhaustion in the trees, to be obtained. This result may be obtained while making considerable reduction in the present expenses of working by intensive tapping.

51 – **Camphor in Formosa.** — *Bulletin économique de l'Indochine*, Year XXII, New Ser., No. 136, p. 491. Hanoï-Haiphong, May-June, 1919.

The quantity of camphor coming from Formosa and exported during the year 1918 was 2 179 558 *kin* (1 307 735 kg.) representing a value of 2 942 011 *yen* (7 599 214 fr. *at par*). Compared with 1917 there was a decrease of 724 431 *kin* (434 659 kg.) and 1 686 266 *yen* (4 356 545 fr.). The cause of this decrease was the development of the celluloid industry in Japan, which uses a great part of this product.

In 1918, 1 658 177 *kin* (994 906 kg.) worth 1 757 120 *yen* (4538 641 fr.) sent to Japan an excess of 405 455 *kin* (243 273 kg.) and 743 830 *yen* (1 921 339 fr.) over 1917.

The consignments of camphor oil to Japan increased to 2 902 134 *kin* (1 741 280 kg.) worth 1 332 869 *yen* (3 442 801 fr.) a decrease of 1 080 694 *kin* (648 416 kg.) and 513 976 *yen* (1 327 605 fr.) on the preceeding year.

52 – **Varieties of Sugar Cane in Porto Rico.** —Earle, F. S. (Agronomist, Insular Experiment Station), in *The Journal of the Department of Agriculture and Labour of Porto Rico*, Vol. III, No. 2, pp. 15-25, bibliography of 9 publications. Porto Rico, April, 1919. SUGAR CROPS

The question of sugar cane varieties has attracted much attention for many years and is clearly of great importance to the planter. The number of existing varieties is very great and increases every year. There is voluminous scientific literature on the subject, so the planter has plenty of material from which to choose ; but in most regions there is a serious want of information regarding the selection of varieties to suit local conditions. A few investigators, particularly Bovell in Barbadoes and Harrison in Demerara (British Guiana), have made most interesting investigations on this subject. This work has been continued over a long series of years and is still being done ; it has served to increase very greatly the average yield of sugar cane. Unfortunately it cannot be assumed that the results obtained are universally applicable. The same painstaking experiments need to be repeated, not only in each of the cane-growing countries, but in each of the principal soil and climatic regions. A heavy yield in sugar per unit of area is what has to be looked for. Unfortunately vigour, weight of the plant and high sugar content are not always found together and some investigators even think that they are antagonistic and that high sugar content is abnormal and always accompanied by reduced vigour. It results that a higher unit yield of sugar may be obtained by a variety with a comparatively low sugar content. For example, in Demerara, the variety " D. 625 " gives a higher yield per unit than any other, and in the

Hawaian Islands almost all the sugar is obtained from " Yellow Caledonia " ; both these varieties are notoriously poor in sugar content.

But there are still many more factors which have to be considered in choosing a variety. With a low grade variety there is a very bulky crop and consequently, much labour is required. The choice of a high or low grade variety will therefore depend also on the local economic conditions. This discussion takes place where the planter crushes his own cane. Generally, on the contrary, the miller buys his cane: he desires the highest grade varieties so that his work and expenses may be reduced, while the planter desires those which give the highest return per area unit.

In any case the greatest possible information is desirable regarding the production, requirements, and resistance to disease and pests of the different varieties.

A discussion of the varieties can be made from two different standpoints: agricultural and botanical or taxonomic. Generally, it has been from the former that the matter has been regarded hitherto, and it is remarkable how few descriptions of cane varieties have been published. The principal object of the paper under review is to show that cane varieties may be described, classified and determined by the ordinary methods of descriptive botany or taxonomy. The author gives a short account of the cultivation of sugar cane in Porto Rico. He studies the different varieties of cane from the standpoint of their cultural value and their characteristics, and he describes the varieties newly grown in the country. In this way he deals with 44 varieties of sugar cane and he adds a key to these varieties.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

53 – **On the Possibility of Cultivating Vanilla at Porto Rico.** — Mac Clelland, T. R., in *Porto Rico Agricultural Experiment Station, Bulletin* No. 26, pp. 1-32, 3 pl. Washington, April, 1919.

The agro-geological and climatic conditions of Porto Rico are favourable for the growth of vanilla, which grows wild in many parts of the island.

In experimental cultivation, using cuttings of *Vanilla planifolia* from the Garden at Miami (Florida), excellent results both as regards quality and yield have been obtained.

As vanilla produce is not very perishable and of small bulk, the author recommends its cultivation in localities which are not well served with roads.

In the bulletin under review the subject is dealt with mainly from technical and cultural standpoints. *Erythrina Corallodendron* makes a good support ; it branches abundantly and can furnish the prunings required to form a layer of humus which is necessary for the growth of the tender fleshy roots of vanilla.

54 – **Tobacco Growing in the Central Province, Ceylon.** — Wilson, W. B., in *Tropical Agriculturist*, Vol. LIII, No. 3, p. 174-175, 4 pl. Veradeniya, Ceylon, Sept. 1919.

Tobacco growing having been tried in the valley of Dumbara (Central Province) for several years and a type of tobacco having been produced possessing qualities suitable for cigar making, the Department of Agriculture commenced, in 1918-1919, experiments at Teldeniya (Dumbara

district) in the interests of the industry. This first year's work has been devoted to fundamental trials, varied experiments and general observation.

Two experimental fields were selected and planted with the following varieties of tobacco :— (1) " Connecticut Broadleaf " (type for American cigars); (2) " Zimmer Spanish " (id.); (3) " Pensylvania Broadleaf " (id.); (4) " Halliday's Hybrid " (id.); (5) " Cuban " (type for West Indian cigars); (6) " Wilson's Hybrid " (type for American cigars); (7) " White Honduras " (type for South African cigars); (8) " Maryland Mammoth " (type for American cigarettes and pipe) (9) " Dumbara " (local type for cigars); (10) " Natal Selections " (type for South African cigars); (11) " Ohio Hybrid " (Cross between types for West Indian and Indian cigars). The seed was sown in well prepared nurseries in January and February, 1919 and, except those of the Cuba variety (No 25. in the list), of which only a small portion germinated, and Sumatra seed, also sown, which did not germinate at all, the seed produced a sufficient number of plants of each kind. These plants were transplanted at the beginning of April. In April and May the weather was exceptionally favourable ; but considerable damage was caused by the " split worm " or " Potato Tuber Moth " (1) and, later, during the dry period in June, by green fly. Other insect pests were not numerous and were easily dealt with.

The growth and the appearance of the tobacco were satisfactory and the following remarks were made :—

" Connecticut Broadleaf ", " Pensylvania Broadleaf " and " Halliday's Hybrid " did particularly well and looked very vigorous ; of these three varieties the first did best ; the third bore leaves inclined to be very dark coloured. " Zimmer Spanish " produced well, but gave somewhat coarse leaves.

Of the " Cuban " variety only a small number of plants resulted at germination and these plants did not grow well.

" Wilson's Hybrid " proved insufficiently hardy. " White Honduras " grew well, but produced very thick leaves, which makes moist conditions and modification in the method of culture desirable for this variety.

" Maryland Mammoth " is very late and dry weather towards the end of the season might cause uneven results.

The Dumbara variety grows without trouble and produces leaves of good texture, but, having a bare petiole it yields a low percentage when the petiole is taken away, and, for this reason it is not recommended.

" Ohio Hybrid " is particularly liable to attack by green fly and does not do well. It is, however, a type of very superior quality and it ought to be further experimented with.

55 – **Possibilities of Cinchona Cultivation in Indo-China.** — CAPUS, in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 10, pp. 310-311, Saïgon, Oct., 1919.

Paper by M. CAPUS, Délégué du Gouvernement général de l'Indochine,

(1) Splitworm = *Phthorimaca operculella* Zell. Cf. *R.*, March, 1919, No. 404. (*Ed.*)

written under this title and from which the *Bull. agr. de l'Inst. Scient. de Saïgon* has abstracted the following information: —

The author recalls experiments undertaken 30 years ago by ALANSA at Mount Bavi in upper Tonkin, germinations obtained at the botanical garden at Saigon, then the more recent experiments of Dr. YERSIN in the mountains of Suôi-Giav (Annam).

The *Cinchonas* grow in America at altitudes between 700 and 2900 m. In Java and the Nilghiris, the first successes were obtained at 2600 m. altitude (minimum temperature 9,8° C,, maximum 20,5°C.), then at Noddivvatum, alt. 600 m. (minimum temperature, 12°, max, 18.8°, C.) (1).

In Ceylon, in the district of Dimbula (minimum temperature 6.90 max, 31.7°, average 18.8° C.) cultivation of cinchona has been undertaken.

M. PRUDHOMME (Directeur du Jardin colonial, Nogent-sur-Marne, France) thinks that the optimum conditions for the growth of cinchona from the standpoint of temperature are the following:— min. 4°, max. 33°, average of the minima 15°, average of the maxima 27°, general average 21°. C (2).. It is admitted in Java that the cultivation of cinchona is not satisfactory below 700 m. in altitude.

The species *C. Calisaya* and *Ledgeriana* are more sensitive to cold than the species *C. officinalis* and *succirubra*. For the two latter the temperature ought not to fall for any length of time, or often, below freezing-point.

Cinchonas require a fairly high degree of moisture in the air. Rain onght to be as frequent as possible, interrupted by dry periods.

The cinchonas are not exacting from an agrologic standpoint. They require a friable soil in which water does not stagnate.

The author thinks, by comparison, that the cultivation of cinchonas could be tried in Indo-Chinani the high vallies of Da-lagna and Don-naï and in the Annamitic Range up to the plateau of Tran-ninh, mentioning specially the plateaux of Lang-biang, Darlac, Bolowens, and Tran-ninh, situated at altitudes varying between 1000 and 1800 m. The Elephant Range in Cambodia may also be worth attention.

56 – **Cultivation of Ipecacuanha, and its Possibilities in Indo-China.** — CHEVALIER, AUG. and LAHILLE A., in *Bulletin agricole de l'Institut scientifique de Saïgon*, Year I, No. 8, pp. 225-231, Saïgon, Aug., 1919.

There are several species of true ipecacuanhas ; false ipecacuanhas, not containin emetin, are also known. The true ipecacuanhas belong to the family of Rubiaceoe, tribe of the Psychotriae, genus *Uragoga* L. = *Cephaelis* Gaertn. = *Pyschotria* L. The species usually cultivated are *Uragoga Ipecacuanha* (L.) Bn = *Cephaëlis Ipecacuanha* Rich. = *Psycho-*

(1) Regarding " La culture de quinquina à Java " see the original article by Dr. J. VAN BREDADE HAAN (Inspecteur de l'Agriculture indigène, at Buitenzorg, Java), published in *R.*, Nov., 1915 pp. (*Ed.*)

(2) This information is taken from M. PRUDHOMME'S book, then director of agriculture in Madagascar, entitled " *Le Quinquina* " (Culture, preparation, commerce), p. 16. (Challamel, Edit., 17 rue Jacob, Paris, 1902). This book includes an appendix on cinchona in Madagascar, pp. 69-80. Regarding the introduction of cinchona into Madagascar see the article by M. J. LEGENDRE summarised in *R.*, Nov. 1918 No. 1247. (*Ed.*)

tria Ipecacuanha Stocks, indigenous in Brazil, where the roots are obtained for exportation (the lesser annulated ipecacuanha). Another species from the equator is *Uragoga granatensis* H. B. (the greater annulated ipecacuanha),

There are several species of *Uragoga* growing in the virgin forests (shady and fresh parts) of Cochin-China and Annam, but no research has yet been made to ascertain whether their roots also contain the precious emetin.

The cultivation of ipecacuanha, outside the countries where this plant is found in a wild state, has been tried in several tropical regions, but its success appears very doubtful.

Several plantations of ipecacuanha have existed, for some years, in the Federated Malay States, and one kind is even known in commerce under the name of " Ipecacuanha of Tohore. "

The cultivation of ipecacuanha having been developed in these States, the authors advise its trial in certain regions of Cochin-China or of South Annam, under the best experimental conditions The attempt is worth undertaking, because of the continued high price of ipecacuanha.

57 - ***Ilex vomitoria* as a Source of Caffein.** — POWER, F. B. and CHESNUT, V. K., in *Journal of the American Chemical Society*, Vol. XLI, No. 8, pp. 1307-1312. Easton, Pa., August, 1919.

In the Southeastern States of North America there is a native shrub, *Ilex vomitoria*, whose leaves contain sufficient of caffein (from 0.3 to 1.67 % of air dried material in the various samples examined by the authors) for the plant to be used as raw material for the extraction of the alkaloid.

Up to the present, caffein has not been found in any other North American species of *Ilex*, or in the European holly, *Ilex aquifolium*.

" Paraguay tea " or yerba maté is obtained from a South American species, *Ilex paraguayensis*.

ARBORICULTURE

58 - **Fruit Trees in Tonkin.** — RETIF, in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 9, p. 295, Saïgon, Sept., 1919.

With reference to the paper by M. AUG. CHEVALIER on " Fruit-trees in Indo-China " (1), the author has sent M. CHEVALIER a note containing new data on the question.

He has seen in the region of Langson, among the Thos, plum-trees, pear-trees and peach-trees, all bearing good fruit when it is allowed to ripen. He also saw cherry trees, of which several measured 30 cm. in diameter. There are large numbers of these trees in the Maoson, at 10 km. from Langson. In the forests of this region, chestnut-trees, pear-trees, etc., are also found.

On the other hand, vines are scattered over the region of Langson. The author has noticed, in the Maoson, vines as thick as an arm, climbing like creepers, and which yield fine bunches of red, sweet, grapes. The Maus sell them during the season in the Langson market. The author

(1) See *R.*, July-Sept, 1919. No. 908. (*Ed.*)

made a barrel of 200 litres of light red wine in 1918, and obtained brandy by distilling the residues and the lees.

59 – **On the Sugar Contents of Cider Apples.** — TRUELLE, A. in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 28, pp. 738-740. Paris, July 30, 1919.

The practical object of this paper is to show cider makers who wish to buy apples to make them into cider or brandy, whether there is advantage in selecting fruit from trees cultivated on hillsides, or plateaux, or from those borne on trees grown in vallies.

The analytical results refer partly to research carried out during 10 years, on a dozen varieties belonging to three seasons or ripenings. However this note nominally concerns only 6 varieties, which are the object of considerable trade in the Auge district: — *1st season:* — Girard — *2nd season:* Cimitière de Blangy, red Fréquin — *3rd season:* Bédan, Binet, Bouteille.

The following, in summary form, is the special information which the author has deduced from chemical analysis, because it presents practical interest, both for the purchase of apples, and the manufacture of cider and brandy: —

(1) The situation of the land, apart from its chemical composition, age of the apple trees with which it is planted, and the surrounding weather conditions, seems, according to whether it is on hillsides, weather plateaux, or in vallies, to exercise an influence on the production of sugar in certain varieties of cider apples.

(2) In the above-mentioned conditions, among the same varieties, cultivated on hillsides and in vallies, the influence of these situations makes itself felt very diversely with regard to the sugar content: sometimes it is the hill side which is best, sometimes it is the valley, sometimes neither is good. Thus of the 6 varieties studied here, Cimitière, Bedan, and Bouteille respond to the influence of the hills, Girard and Binet to that of the vallies and red Fréquin remained unaffected. It is possible, considering results obtained from 6 other varieties, of which the analyses have not been given in this note, to classify Aufriche, Citron, Marin-Onfroy, Peau de Vache with the former, and Gros Matois and red Joly with the latter.

(3) The differences between the extreme degrees in the scale of density and the corresponding weights of sugar, which exist in the various juices of the same variety, have a wide range, but if only the average of the sugar in these juices, taken as a whole, for each kind of ground, are compared one with another these differences become very slight.

(4) The situation of the ground on hillsides, plateaux or in vallies only appears to have, under the conditions indicated, a generally slight influence on the production of sugar in the varieties of cider apples. Again, for the buyer who, only wishing to make ordinary ciders or brandy, in the first place requires a high total sugar content, the situation of the orchards has only relative importance, and comes after the nature of the variety, which, on this point, comes before the composition of the soil.

It would be quite different if it was a question of the preparation of high grade ciders, because, besides sugar, there are all the other constituent principles of the juice, which, according to their proportion, play a considerable role, both from the standpoint of the preservation of the ciders made, and of the elaboration of the different peculiarities of their taste, which the soil, according to its very distinct composition, very often modifies more or less agreeably to the palate. Also, to obtain more finely fruited and lasting ciders, the author would give the preference to apples coming from the hills, over those picked in the vallies, varieties being identical.

60 – **Use of Sulphur in Viticulture.** — CHAUZIT J., (Communicated M. VERMOREL) in *Comptes rendus des séances de l'Académie d'Agriculture de France* (French National Society of Agriculture) I, Year 1914, No. 2, pp. 48-51, Paris, Jan. 14, 1914. — II, Vol. V, No. 52, pp. 835-837. Paris, Oct. 22, 1919. VITICULTURE

I. — According to the experiments *in vitro* of MM. BOULLANGER and DUJARDIN (1), according to the experiments in pots of MM. VERMOREL and DANTONY (2), and according to his own large-scale, experiments the author believes it possible to state : —

(1) That the greater the quantity of organic matter available in the soil, the greater is the effect of sulphur ; when the quantity of organic matter decreases, the effect of the sulphur diminishes, becoming almost negligible when there is no organic matter.

(2) That when sulphur is incorporated with the organic mass on which it is intended to act, its effect is more clearly noticeable.

(3) That the yield increases according as the proportion of sulphur used is greater.

II. In the new experiments, the principle of the conclusions of 1914 is confirmed. Whether the sulphur is applied to a vine that has not been manured for 2 years, or whether it is used on a vine which was manured with stable manure, the author has noted, in both cases, important increases of the crop.

The amount of sulphur used was 200 kg. per hectare.

In the experiments of MM. VERMOREL and DANTONY, pyrites were used, whereas in those of the writer sulphur was used. M. HALLER, present at the meeting of the Academy, observed that in the case of pyrites, these oxidise, and give sulphate of iron ; sulphuric acid, produced from this sulphate, fixes ammonia, and prevents loss. The question was therefore, according to him, whether the sulphur oxidised ; it would also, in that case, have the effect of fixing the ammonia, and the result would be the same. This is a possible chemical explanation of the phenomena observed.

61 – **The Forests of the Grand Duchy of Luxembourg.** — *Journal de la Société Nationale des Agriculteurs de Belgique*, Year I, No. 12, p. 157, Brussels, August. 2, 1919. FORESTRY

One third of the total area of the Grand Duchy of Luxembourg, 80,00 ha., is covered with forests, including 20,000 ha. of coppice for bark, 50,000

(1) See *R.* Oct. 1912, No. 1397. — (2) See *R.* Jan. 1914, No. 18. (*Ed.*)

ha. of high forest of beech, treated under the selection method, and 10,000 ha. of conifers. The State owns only 2000 ha., communes and public institutions 30,000 ha., and the rest, which includes almost all the coppice for bark, belongs to private persons.

The coppice for bark, almost valueless before the war, has given enormous revenues during the war, tanning having attained unusual prices.

Among the coniferous species the Scots pine predominates on dry sandy soils, whilst spruce prevails on the best soils. The pit props, which conifers furnish, are almost exclusively exported to Belgium, in spite of the import duty imposed upon them at the frontier. The small quantity of sawn coniferous timber is sold in the country itself.

The greater part of the Luxembourg forests is composed of beech, mixed with oak, and treated as high forest, under the selection method. Beech, for lack of demand as timber, is almost entirely sold as fire wood, and consumed in the country. During the war, it is true, large beech logs sold at very high prices. Oak, which forms only 5 to 10 % of the total, is sawn up in the local raw-mills. Pit props of this timber are bought by the mining companies of the country.

The 30,000 ha. of woods belonging to the communes are under the forest law, and divided into 4 districts. The communal woods, almost exclusively composed of high forest of beech, treated under the selection method, with 10 % of conifers, are the finest in the Grand Duchy

62 – **Forest and Timber of the Adana Vilayet, Turkey.** — Egyptian Expeditionary Force, Intelligence Branch, in *The Board of Trade Journal*, Vol. CIII, No. 1188 pp. 304-305. London, Sept. 4, 1919.

The forests of the Taurus, Anti-Taurus, and Amanus mountains, within the boundaries of the Vilayet of Adana, are, in comparison to the area involved, among the most important in the world. Their importance is due to four causes : —

(1) Their situation as regards markets.

(2) The quality of the timber.

(3) The practically unlimited water power in the province for working sawmills and electric transporters.

(4) The large permanent rivers flowing through the principal forests, affording a simple and cheap means of transport for lumber to the railway or the sea.

For many years these forests have been devastated by uncontrolled cutting and forest fires. These latter were occasionally accidental but usually they were lit intentionally by nomadic tribes from Aidin. Moreover, though all forest lands are State owned, till quite recently no attempt at re-afforestation was made.

The total of so-called " forest lands " is about four million acres but the area of timber forests (i. e., whose timber is of commercial value as timber) is 4 206 550 donums, which represents a little under one million acres (one acre equals 4.4024 donums). The following list shows the percentage of the different species of trees found in the forest. The figures

are only approximate, but must suffice, as no more exact information is procurable :—

Pine (5 varieties)	40 %	White Cedar	10 %
Oak (3 varieties)	17	Spruce (3 varieties)	5
Mulberry		Wild Olive	3
Alder		Birch	2.5
Caroub		Wild Cypress	2.3
Willow		Juniper	1.5
Holly		Plane	1.3
Ilex		Box (2 varieties)	6
Arbutus	16	Beech	5
Walnut		Yew	3
Bay			
Poplar			
Berries			
Other small trees			

The Ak Tcham, or white pine, is the most valuable tree in the province. It resemble the Swedish Pitch Pine, but is finer in the grain, easier to work, and more durable. It is not found at an altitude of less than 4 000 feet. This tree is 100-120 feet in height, absolutely symmetrical, and the same size almost the whole way up. It is 3-5 feet in diameter and the only branches are at the top. It is believed that there is no tree in Europe to equal it for size, quality, and symmetry.

The Karra Tcham, or black pine, resembles the Norwegian Pitch Pine but is harder, coarser, and more resinous. It is used for sleepers and roof timbers. The other varieties of pine, though of little commercial value as timber, are very resinous and give such by-products as pitch, Stockholm tar, resin, turpentine, and wood alcohol. These trees grow on the lower slopes of the mountains.

The white cedar grows at an altitude of 4 000-6 000 feet. It is an excellent timber for cabinet-making, and will never rot. The spruces (*Picea excelsior*, *Picea orientalis*, and *Abies cilicia*) are all of value for making wood-pulp for paper.

The large forests of wild olives could be properly grafted and made the source of substantial revenues.

The mulberry is indigenous to the country. The silk industry in the Vilaget was renowned, but in 1900 the Turkish Government imposed such high taxes on the mulberry trees that the industry has now entirely disappeared. The yearly silk output was 10 000 okes, *i. e.*, 28 320 lb. (1 oke equals 2832 lb.).

The total quantity of timber (of commercial value) in the forests is slightly over 50 million cubic metres, *i. e.*, 1 750 million cubic feet. During the war the Turks used 250 000 tons, *i. e.*, about $^3/_4$ million cubic metres, of Cilician timber for fuel on the railways.

63 – **The Lumber Trade of Bolivia.** — HAZELTINE, C., in *Commerce Reports*, No. 187, p. 820. Washington, D. C., Aug. 11, 1919.

Although Bolivia produces an infinite variety of valuable cabinet

woods, such as walnut, cedar, mahogany, ebony, and laurel, the lack of internal transportation facilities makes it necessary to import large quantities of construction lumber. Bolivia's lumber imports in 1914 aggregated 23 631 metric tons and were valued at $453 418. Chile and Argentina supplied the 6 tons of this which were classed as cabinet woods ; 5 773 metric tons of railway ties, valued at $230 906 were imported, chiefly from Chile ; and of the 17 852 tons of other lumber the United States supplied 15 213 tons (chiefly Douglas fir), valued at $187 178.

64 – **Scots Pine of Belgian Origin.** — POSKIN, A. (Professor at the State Agricultural Institute of Gembloux), in *Bulletin de la Société Centrale Forestière de Belgique*, Year XXVI, Vol 4, pp. 139-154, and Vol. 5, pp. 203-222. Brussels, July 15 and Aug. 15, 1919.

Notes on Scots Pine collected in Belgium since 1912 This tree, so common in Belgium, is not only interesting on account of its timber but also on account of the large crop of seeds which it produces in Lower Belgium. The author, in the first place, states that the seed of Scots Pine of Belgian origin is not inferior in quality to that produced elsewhere, and he considers that the following basis might apparently be adopted in the utilisation and sale of these seeds :—

(1) The Scots Pine of Lower Belgium is well suited to the local conditions and succeds well there. It can also be grown in Middle Belgium. In the Ardennes we are less well informed regarding the variety which is most suitable. The pine of the lowlands has so far done well in experimental planting, on a small scale, carried out up to an altitude of about 400 m. The value of the seed gathered on the spot is not yet sufficiently known to enable it to be used with confidence when taken from good stands; besides, the greater part of the pine woods is formed with seed of Campine or foreign origin. This point requires close investigation, for the Scots Pine has been largely planted and there are complaints of its premature decay in certain places, especially in the Middle Ardennes.

(2) It is desirable that seedsmen should organise themselves methodically and give information in their catalogues regarding the purity, germinative faculty (already done, but very imperfectly), so that a judicious and well founded choice may be made. Since in the present state of information, the seed of stunted Scots pines is not to be trusted, it would be well if seedsmen commenced by selling, under guarantee, seed from good parent trees. It would be well to cary out intensive research regarding the origin of the seed of Scots Pine.

(3) Commercial seed too often has insufficient germinating power ; the bad quality is due either to unfavourable conditions of origin, or to defective or prolonged keeping. There is every reason to use as good seed as possible, as the yield of plants is then proportionately greater. Germinative power for Scots Pine ought not to be less than 75-80 % ; that is for seed of at least 1 year old, according to the author's tests.

(4) It would be well for the purchaser to stipulate in all selling contracts, for most forest seeds, a minimum purity and germinative power, quality guaranteed by the seller and controlled by a seed-testing station.

This method might be still further improved with the object of obtaining as perfect seed as possible. — The minimum power of germination required for Scots Pine is, for example, 80 % (often it is less ; the parties in the matter dare not fix it too high). In this case the seller has nothing to gain by supplying seed of greater power of germination. Would it not be more rational, while requiring a minimum quality and making an analysis after delivery, to fix the price of the seed according to the percentage of cultural value indicated by the testing station, as is commonly done in the chemical manure trade ? — It would be agreed, for example, to pay at a unit rate of 0.10 fr. If the cultural value recorded by the testing station is 85 % the seed would be worth 8.50fr. per kg. : the seedsman and the buyer would thus both benefit, the former by delivering and the latter by using, first quality seed.

(5) Partnership ought, apparently, to give good results in the matter of forest seeds.

The State would act wisely, it seems, by centralising, through the agency of its Forest Administration, the orders for the principal seeds required for the State nurseries and afforestation. It might perhaps help the Communes and public Institutions by supplying certain seeds. Nursery gardeners and private land-owners would also find it very advantageous to combine for purchasing seed, through special forestry societies or agricultural co-operative societies, of which a good number already exist in Belgium, combining their orders for various products such as manures, seeds machinery, etc. Such combination would have a healthy influence in extending and facilitating the practice of analysis, in obtaining favourable charges from testing stations, and in requiring real guarantees regarding the origin and quality of the goods.

65 – **Effect of Grazing upon Forest Reproduction.** — I. Sparhawk, W. K. N. (Forest Examiner), Effect of grazing upon Western Yellow Pine Reproduction in Central Idaho. in *United States Department of Agriculture, Bulletin No. 738 ,Contribution from the Forest Service,* pp. 31, pl. 4. Washington, D. C. 1918. — II. Sampson A. W.)Plant Ecologist), Effect of Grazing upon Aspen Reproduction. *Ibid.*, No. 741. pp. 29, fig. 7, pl. V, 1919.

The regulation and control of grazing is of far-reaching importance in the organisation of absolute forest land for the continuous production of crops of timber. Too often in the past the United States has sacrificed reproduction in order to placate the cattle and sheep men, sacrificing thus reproduction at the most opportune time for obtaining it, and now it can only be secured by planting, often at prohibitive costs.

Throughout most of the western United States grazing on absolute forest land is of vast economic importance, and the forester accepts the general principles that grazing must be carried on as a part of forestry management.

He does not object so much to grazing as he does to unregulated grazing. In many parts of the westernUnited States the present economic importance of grazing so overshadows the importance of the forest for the production of timber that there is grave danger in overgrazing much of the

absolute forest land, which will lead to a gradual destruction of the timber now standing and more or less complete elimination of reproduction following fires and lumbering.

One of the most important problems dealing with large areas of the absolute forest land is how intensively can it be grazed without serious injury to it as a forest. The many researches conducted by the United States Forest Service and by other agencies in recent years have thrown much light on grazing problems in relation to natural reproduction (1).

I. — A recent study was made by the U. S. Forest Service of the effect of sheep grazing on a number of sample plots on three grazing allotments between 1912 and 1914 in the National Forest of Central Idaho. Sheep injure forest reproduction by browsing and by trampling. Slight browsing of the needles, of side branches, of the leader, or of the bark does practically no damage to the tree, though when repeated it may result in stunted growth or the death of the tree. Severe browsing, as occurs around bed grounds, often kills the seedlings. Trampling usually is not serious. Damage to seedlings more than a year old is negligible: while as high as 100 per cent — an average of about 20 per cent. for all plots — were killed when less than one year old. Western yellow pine (*Pinus ponderosa*) is injured the most by browsing, lodgepole pine (*P. contorta*) less so, and Douglas fir (*Pseudotsuga taxifolia*) least. White fir (*Abies concolor*) is practically never browsed. Of 1782 seedlings killed, 73 % were less than a year old, and but 5 % were over 6 inches in height.

Injuries which did not result in death were greater late in the season than during the earlier period, due to drying of the forage as the season advanced. Those killed by grazing were greater earlier in the season than later, as the stem breaks more readily when succulent than after lignification has set in. Injury and death increased fairly constantly with increased intensity of grazing, though after a seedling's third year less than 1 per cent. per year, of the trees is killed by grazing of moderate intensity. More than three times as many seedlings are killed by other causes than sheep. Drought, winter-killing, rodents and birds, and fungous diseases, were the chief causes of death, while frost, rodents and birds are responsible for minor injuries. The benefits of sheep grazing to the forest are through the reduction of fire by the destruction of the inflammable material and the aid to natural forest reproduction, which is often overestimated.

II. — Another study of the United States Forest Service deals entirely with the effect of grazing upon aspen reproduction. This study was conducted in the Monti National Forest, in Central Utah, and clearly shows that great damage to the natural regeneration of this species results from both sheep and cattle grazing, although the regeneration usually appears in dense stands and is almost entirely from root suckers. There is little or no aspen reproduction until the stands are severely opened up by lumbering or fire. Fully stocked reproduction is best after clear-cutting. The author's studies appear to show that even where sheep in moderate numbers

(1) See *R.*, 1918, No. 1365. (*Ed.*)

are permitted to graze on such clearcut areas the aspen reproduction is often destroyed, almost, to the last sprout. The damage done by sheep is much greater than by cattle, and the damage by both depends upon the duration and intensity of the grazing.

The experiments extended over a period of five years, and sample plots were established on clear-cut areas, which were studied each year and records made of the reproduction. Some of the plots were lightly grazed, others moderately grazed, and still others heavily grazed. The amount of damage on all plots varied somewhat with the season. The mortality of one-year-old sprouts, even under light grazing, is so high it is reasonably sure to have a determined effect on the stand of timber. If the sprouts that appear the first year after clear-cutting are destroyed by grazing, the sprouts, the succeeding year, are much less vigorous. Those produced the third season and later are distinctly lacking in vigour and are of little value for regeneration. Aspen sprouts grow rapidily, and at the end of three years they attain a height which exempts them from destructive grazing by sheep, and after four or five years are damaged little by cattle. The problem, therefore, seems to be the protection of reproduction for a period of three of five years after clear-cutting, or at least to protect it adequately to assure reproduction in fully stocked stands. Although the author believes that very light grazing by sheep may do little harm, he does not believe it practical to attempt sheep grazing for a period of three years after clear-cutting. He is of the opinion, however, that the moderate grazing of cattle will still permit a sufficient number of sprouts to survive to form a fully stocked stand. It appears to be necessary in order to obtain an aspen reproduction either to exclude stock altogether for a period of three years, or in the sheep country to shift from sheep to cattle for a three-year period when sheep can again be safely grazed. Where the aspen is not in a cattle country the only necessity in order to obtain reproduction is to control the grazing and properly distribute the stock by means of drift and division fences.

The bulletins under review are additional evidence of the great injury to forest reproduction on absolute forest land by uncontrolled and unregulated grazing. The accumulated evidence of the past decade should force every thoughtful man to the realisation that grazing is a serious menace to the natural reproduction of forests. The first duty of the forester is reproduction. Upon him falls the responsibility for successful crops of timber on absolute forest land under his control. It is his duty, therefore, and not of the stockman, to determine when and where stock should be grazed and when they should be excluded from given stands. It should be his province to decide the grazing possible within the limits of good forestry. The pressure for grazing areas in the western United States must not force grazing beyond the limits of the forest, thus causing its detriment and possible destruction (1).

(1) See *Journal of Forestry*, Vol. XVII, No. 5, pp. 564-566, 1919. (*Ed.*)

66 – **Method of Working Bamboos.** — MARSDEN, E. (Silviculturist, Forest Research Institute, Dehra Dun), in *The Indian Forester.* Vol.XLIV. No 4. pp. 147-165. Allahabad, 1918.

In 1910, experimental plots were laid out to ascertain the best system of working *Dendrocalamus strictus* bamboos, and these have been examined in detail annually. The methods under experiment have been: —

(1) *Rotation*: *a*) Cutting the bamboos annually; *b*) cutting the bamboos every second year; *c*) cutting the bamboos every third year; *d*) cutting the bamboos every fourth year.

(2) *Proportion of bamboos cut in the* 1 *and* 2 *year rotation clumps*: *a*) cutting all bamboos except the new shoots of the current year, *b*) cutting of half the bamboos except the new shoots of the current year.

(3) *Height of cutting*: *a*) cutting the bamboos above the first node i. e. close to the ground; *b*) above the third node; *c*) above the fifth node.

Two localities were selected for these experiments, in the United Provinces of India, one dry and the other comparatively damp. In one of these localities three clumps of bamboo and in another, five clumps separated from each other and distributed over the plot, were subjected to each variation of experiment.

In recent years, before the experiment was begun, the bamboos in these two localities had been worked under a three year rotation, all culms, except the shoots of the current year, being cut regularly. Thus, at the time the experiment started, no culms were more than two rains old. Before beginning work on the experimental plots, all clumps were thinned of dead or imperfectly developed culms.

The following show the results of the experiment with *Dendrocalamus strictus* in the United Provinces of India only;—

1) Annual working, whether cutting high or low, whether removing all old culms or leaving half of them, leads to more or less rapid reduction in the size of the clumps, in the number of new shoots, and in the girth of culms.

2) When all the culms except those of the current year are cut, the clump deteriorates. This is true for 1 year, 2 and 3 year rotations, and for cutting at the height of one node, three or five nodes. When the rotation is 4 years this result is less obvious.

(3) When the rotation is one year and only half the number of old culms is cut, the results are better than when all old culms are cut. The height at cutting makes no difference. Of 15 clumps treated thus, two only were in good condition; this method cannot then be recommended. If only half the old culms were cut, the clumps under a 2 year rotation were in much better condition than those under 1 year rotation.

(4) Whatever the rotation, a certain number of old culms should be left for two reasons: *a*) for the mechanical support of new shoots; *b*) to maintain the rhizomes in full vigour.

(5) The effect of difference in height of cutting upon the health of the

clump is negligible. Cutting too high produces a number of twigs at the top of the stumps, which impedes working.

The production of new shoots is not affected by the height of cutting the culms. But removing half the old culms gives more shoots than clear-felling all old culms, and 2-year rotation more than 1-year rotation. Of the methods under experiment, most new shoots were yielded by the clumps worked under a 2-year rotation, when half the number of old culms were felled.

Felling all the old culms fails to produce many new shoots, even when the rotation is four years. It is, however, probable that a 3-year rotation, some of the old culms being left standing, would give better results than a 2-year rotation.

Clear-felling all culms including those of the current year, nearly, but not quite, kills the clumps. After four rains, the clumps are beginning to look up again, and shoots about $^3/_4$ inch thick begin to arise. Repeating the complete cutting of all culms for two consecutive years would probably here kill most clumps.

To work economically, it would appear that in each clump some old culms should be left standing a 2-year rotation, leaving half the old culms standing may be better than a 3-year felling of all the old culms, but a 3-year rotation leaving some few old culms would perhaps be still better.

A system of working bamboos may be based on the size of the clump, on the number of new shoots produced, or on the minimum number of old culms to be left standing. In every case the system chosen must be one which admits of easy check. If a certain proportion of the old culms is laid down as the standard, it is in practice difficult to check whether too many culms have been felled or not. Similarly, any rule prescribing a minimum number of old culms to be left standing based on the number of new shoots is equally impracticable.

It would be simpler to fix a minimum number of old sound culms at least 1 inch thick, which must be left in each clump. But the size of clumps varies, so the average size of clumps in the locality must be ascertained. If each average clump contains 20 old culms, and the rotation is 3-years, a minimum of seven old culms per culm might be fixed.

Another problem is the distribution within the clump of the culms left standing. Clear-felling part of the clump is liable to kill that part: the culms left standing should therefore be distributed evenly over the clump.

While a fully-stocked clump produces more shoots than a severely worked clump, there seems ground for belief that where kept in an open condition, more shoots will arise than if allowed to become congested. Loosening the earth and heaping it up round the base of the bamboo clump is likely to stimulate the sprouting of new buds. When the bamboos have been worked continuously for years, it might be highly beneficial to give the clumps a rest for 3 to 4 years before introducing the new method of treatment.

LIVE STOCK AND BREEDING.

HYGIENE

67 – **Poisoning of Calves by *Iris*, Observed at Abbotsford, British Colombia, Canada.** — BRUCE, E. A., in *Journal of the American Veterinary Medical Association*, Vol. LVI *v. LVI, New Series*, Vol. 9, No. 2, pp. 72 74. Baton Rouge, Oct., 1919.

LINNAEUS had previously observed that Irises are poisonous to cattle, but cases of poisoning by these plants are rare. Some cases of human deaths caused by eating the rhizomes of *Iris versicolor* in mistake for those of *Acorus Calamus* and several other species considered poisonous because they contain bitter resins and iridine, a purgative glucoside, have been noted. The author has noted 3 cases of poisoning of calves of 3, 4 and 4 1/4 months respectively, which, being shut up in an enclosure, ate the rhizomes of a species of Iris which chanced to lie on the ground ; two of them died before the second day and the third succumbed on the 4th day. The principal symptoms were :— profuse salivation ; inflammation and hardening of the ganglions of the head and neck ; appearance of ulcers on the lips and muzzle ; acute pain in the belly ; faeces tinged with blood shortly before death. Post mortem examination showed — irritation of the 3rd and 4th stomachs ; black spots on the intestines ; kidneys, liver and spleen very dark in colour.

68 – **Treatment of Horse Mange by Chloropicrin Fumes** (1). — BERTRAND and DASSONVILLE, in *Comptes rendus de l'Académie des Sciences*, Vol. 169, No. 10, pp. 486-489. Paris, Sept., 1919.

The energetic insecticidal action of chloropicrin having been already reported by the authors, (1) they whished to try it in the treatment of horse mange. The horses were shut up in closed boxes, from which only their heads emerged through an opening, a canvas collar holding the head of the animal. In the boxes 20 gm. of chloropicrin per cubic m. were projected, by means of a syringe, furnished with a vaporising nozzle, avoiding direct

(1) See *R.*, July-Sept. 1919, No. 1050, and No. 6, of this *Review*. The experiments of the authors confirm the results of research, previously carried out by Mr. W. MOORE, who has stated in a former paper (*Journal of Lab. and Clinical Medicine*, Vol. III, No. 5, pp. 261-268, 1918) that thecompound in question is efficient as a fumigant against lice in clothes, into which it penetrates completely, killing all the adults in the space of 15 minutes, and their eggs in the space of half-an-hour ; the destruction of insects takes place all the quicker, if the temperature of the fumigating room is higher. In another paper (*Journal of Economic Entomology*, Vol. XI No. 4, pp. 357-362, 1918) Mr. MOORE has described some tests carried out by himself at the Agronomic Station of Minnesota, with the following results : — Chloropicrin using 8 to 16 g per cubic m. destroys insects which carbon disulphide could destroy using 48 to 58 gm. per cubic m. In the disinfection of seeds, it is true that chloropicrin is more likely to injure the germinative faculty than carbon disulphide, but if normal quantities are used, if the seeds are dry, and if care is taken to ventilate well after fumigation, the seeds would keep their physiological soundness. Chloropicrin penetrates, in 24 hours, through sacks of flour of 23 kg. at a temperature of 20° C, killing all insects infesting the flour; it was noticed, on the other hand, that this insecticide slightly diminishes the bread-making value of the flour. Chloropicrin free from impurities (chloride and peroxide of nitrogen) does not damage cloth, and does not affect colour (*Ed.*)

projection of the liquid (very irritating) on to the animals. The animals remain in the box for half-an-hour. The head of the horse is coated with an ointment composed of 2.5 gm. of chloropicrin to 100 gm. of vaseline. The vapour bath is repeated a second time at the end of 2 or 3 weeks. The results were enterely satisfactory.

Compared with the treatment of mange by sulphur dioxide fumes, treatment by chloropicrin fumes has the advantage of being: — more rapid (30 minutes instead of 2 hours) ; easier (there is no sensible increase in the atmospheric pressure inside the boxes, which does away with the necessity for absolute airtightness ; besides the new method has no destructive effect on the material of the collars, requires no special vaporiser etc) ; is surer ; and less dangerous for the animals.

69 – **Period of Incubation of the Eggs of *Haematopinus asini*** — Bacot, A. and Linzell L., in *Parasitology*, Vol. II, No. 3 and 4, pp. 388-392. Cambridge, Oct., 1919.

Three kinds of lice are found on horses ; two Mallophaga (*Trichodectes equi* and *T. pilosus*) and one Siphunculata or blood sucking louse (*Haematopinus asini*); this last is much more common than the others and also it causes greater irritation. In badly infected cases it causes constitutional disturbances and emaciation ; possibly, like many other blood-sucking insects, it is a carrier of disease, although hitherto no disease can be definitely attributed to it ; lastly it is very difficult to destroy.

The authors, therefore, thought it desirable to study the development of the eggs of this parasite at the Central Veterinary Research Laboratory, London.

Conclusions. — (1) The eggs of *Haematopinus asini* may take 1 month, or more, to hatch. Animals undergoing treatment for the destruction of this louse must consequently be kept under observation for at least 34 days after the commencement of treatment. It has not been possible to determine the minimum time which should elapse between the laying of the egg and the fertile female, but, from analogy, it ought probably be a fortnight, for it has been found that in insects of this class the periods of maturation and incubation are approximately equal. This would mean that supposing all active stages are destroyed at each insecticide treatment and that the treatments are repeated at 10 days interval, at least 4 treatments are required, because, even if no eggs were laid during the treatment, it is very probable that, if that period is reduced, a few eggs existing at the commencement of the treatment may hatch out after 1 month and cause a new infection.

(2) The normal period of incubation appears to be from 16 to 20 days ; the minimum period, in natural conditions from, 15 to 16 days.

(3) A very limited amount of dry heat destroys the eggs. Even at blood heat, 24 hours in dry air prevented the eggs from hatching. It is evidently due to temperature that lice migrate during hot weather to the sheltered parts of the body. The eggs are usually laid close to the skin and, in partly clipped horses *the lice migrate* to the unclipped parts.

(4) Moist cold destroys the eggs, while dry cold has only the effect

of prolonging, by a few days, the period of incubation. It has not yet been possible to determine how long they can stand dry cold, but a week in a dry cold room at a temperature of about 50° F. destroyed about 50 % and prolonged the incubation period (normally 16 days at 100°F.) of the others to 18 days.

70 – **Determination of the Activity of Malleins.** — FAVA, E. in *Il Nuovo Ercolani*, Year XXIV, No. 16, pp. 193-198; N° 17, pp. 209-218, 1 diag., 6 tables, Turin, Aug. 31 and Sept. 15, 1919.

The author insists on the expediency of extending State control to specific products, which might be of use in the diagnosis of infectious diseases. The toxic power of mallein can only be estimated by experimenting with this substance on animals suffering with glanders; the author proposed to determine if it was possible to obtain sure results by employing for the purpose guinea-pigs attacked by glanders. He used malleins prepared in 7 different Institutes: — Italian, French and Swiss he diluted them with physiological salt solution containing 0.85 % of sodium chloride in decreasing proportions from 1 : 3 to 1 : 200; a quantity of the dilutions thus prepared was mixed with an equal volume of fresh superimmunised serum in a first series of tests; with one half of the volume of serum in a 2nd series; with 2 volumes of serum in a 3rd series. The mixtures thus prepared, rendered homogenous by shaking, were heated to 37° C., and read after ½, 1, 2, and 4 hrs, then placed at a laboratory temperature, and read at the 20th hour. A series of tables gives the results of these experiments of precipito-reaction.

The malleins were tested in parallel on guinea-pigs given glanders by means of a bacillary emulsion, obtained from 24 hr. cultures in glycerined agar, from a stock taken from the ass.

Some guinea-pigs were experimented on with malleins, 36 to 48 hours after the appearance of specific symptoms, others at an advanced stage of experimental contamination. The different malleins were given by an intracerebral injection, in doses of 0.05, 0.10, and 0.15 cc. diluted in an equal volume of 0.85 % physiological solution, and by an intravenous injection in a dose of 0.50 cc, diluted in a triple volume of physiological solution; 2 tables give the results so obtained.

The author remarks that the intracerebral injection does not allow of the exact estimation of the toxicity of malleins in guinea-pigs suffering from glanders, because the peptone contains amino bases (especially tyramin), which may cause in intracerebral innoculations a symptom resembling an anaphylactic shock.

CONCLUSIONS. (1) The control of malleins, on subjects suffering from glanders (guinea-pigs), requires much time, and consists of a complex, delicate, dangerous and costly method. Moreover, this method does not always give constant results, because of the intervention of the personal factor, which is not to be neglected, even if animals of the same age, of almost the same weight, infected by the same virus, and with the same quantity of it, are operated on.

(2) In the preparation of serum against glanders, BERTETTI and FINZI used precipitogenous substances from *Bacillus mallei*, which give rise to super-rich serums of specific precipitins.

Functional groups (haptophorous and precipitophorous group) of precipitable substances, (malleins), which, in the case specified, are the above-mentioned immunising precipitogenous substances, find their corresponding specific in the precipitins of super-immunised serum against glanders.

(3) The precipito-reaction, obtained with super-immunised serums against glanders, is absolutely useful and practical because of its easy use, its simplicity, and its certainty in the estimation of the toxicity and of the activity of the malleins put on the market.

(4) The greater the degree of dilution, at which it contains sufficient quantity of precipitable substance, able to react with the precipitins of super-immunised serum against glanders, the more active is the mallein.

71 – **The Control of Cattle Plague in Indo-China.** — SCHEIN, H. (Veterinary surgeon at the Pasteur Institute of Nhatrang, Annam), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 3, pp. 65-73. Saïgon, March, 1919.

Cattle plague is the most feared epizootic disease in Indo-China, where it has been known from the remotest times.

The author studies the disease, passing rapidly over well-known general facts, laying stress on the local conditions, and on the latest scientific opinions, so as to determine clearly the present state of that important question so far as Indo-China is specially concerned.

SPECIES ATTACKED.— All domestic and wild ruminants. Sheep and goats themselves are liable to contract the disease, and to transmit it. The Pasteur Institute at Nhatrang has recently proved that the Indo-Chinese goat is at least as liable as the buffalo to the innoculated disease, thus constituting an excellent subject for experiment. M. M. CARRÉ and FRAIMBAULT, at that Institute, have shown that, contrary to what was thought, the pig can be infected and a transmit the disease.

Wild ruminants, or wild boars, beasts of the forest are therefore liable to preserve and spread the virus. But infection by them is uncertain and accidental, and if we are defenceless against it we must nevertheless fight against the disease.

China constituted for Indo-China a veritable reservoir of virus ; while cattle plague has disappeared from Annam, Tonkin is still, most certainly by Chinese infection, ravaged by it. This is a most useful indication : if cattle plague is not endemic in Indo-China, it would be possible to obtain its total suppression (1), by an energetic use of all the available measures.

SENSITITY OF VARIOUS BREEDS. Annamite cattle are relatively very slightly sensisitive to virus. Letting the disease spread freely, the mortality varies from 30 to 50 % of those attacked. On the contrary, the improved breeds, resulting from crossing with European cattle, as well as

(1) See *R.* March, 1919, No. 333. (*Ed.*)

buffaloes, pay a much higher toll, which may be as high as 90 % of the animals attacked. Nothing is at present known regarding the relative susceptibility of the other breeds (of Cambodia, Yuman, Jhanh-hoa, etc.)

INDIVIDUAL SENSITIVITY. — In various countries (the Philippines, Erythrea), it has been noticed that animals living on the heights are less affected than those living in the lowlands. The buffalo, pre-eminently an animal of the lowlands, is extremely sensitive.

But possibly there may be resistance to infection through immunity. (1) Hereditary immunity (by Darwinian selection) (1) active immunity (by previous attacks; this is the most effective; (3) passive immunity by the antitoxins of the serum of the mother's milk, for the young who are sucking.

The anthor describes the symptoms, diagnosis, injuries, bacteriology, sanitary precautions, antiplague serum.

ANTIPLAGUE SERUM. — It was discovered, and brought to notice, simultaneously by KOLLE and TURNER, in South Africa, and by CARRÉ and FRAIMNAULT at the Pasteur Institute of Nhatrang. Since then improvements have been made in its preparation, tending mainly to reduce the net cost. The most important is due to M. NICOLLE, who at the Pasteur Institute at Constantinople, substituted for virulent blood the liquid from peritoneal washing of an animal suffering from the disease, as the source of virus intended for super-immunising the animals producing serums. There are two methods of serotherapy : — " sero-infection " which is a true vaccination (a mild form of the disease is given to the subject), and " passive immunisation ", by the use of serum alone. According to the author, sero-infection is the better process.

Great care should be taken, when a newly imported animal is being injected, not to inoculate it with germs of other diseases, or protozoa.

The author concludes that the most formidable of cattle infections in Indo-China may be considered as conquered, and that, if it is really desired, breeding could become a very great source of wealth of the colony, and a valuable source of preserved and frozen meat for France.

72 - **Haemorrhagic Septicaemia in Indo-China.** — SCHEIN, H., in *Bulletin Scientifique de Saïgon*, Year I, No. pp. 257-264. Saïgon, Sept., 1919.

The question of haemorrhagic septicaemia has led to lively controversies in Indo-China. Up to 1919 all the cattle diseases, in this colony, were included under the name of " cattle plague ", thus denying the existence of haemorrhagic septicaemia; then there was too much generalising in the opposite sense, by denying even the existence of cattle plague. The two epizootic diseases most certainly exist as the works of the author (Bacteriologist at the Pasteur Institute at Nhantrang, Inspector of Epizootics), made in collaboration with M. YERSIN, have affirmed.

The author, owing to the interest which the question presents, drew up a statement : — on haemorrhagic septicaemia (describing its 4 forms, super-acute, acute, sub-acute and chronic), on its treatment, (intravenous injections of iodine, carbolic acid, collodial silver or aniodol used internally, mild laxitives, alcohol, bitters (nux vomica), rich, nutritive and easily

digested food) — of bacteriology, — of the diagnosis of vaccination, and of serotherapy (it appears that fairly good results can be obtained by vaccination with the bodies of microbes, killed by glycerin, and injected with the latter according to DR BERNARD'S method for the preparation of the anti-staphylococcic vaccine, on prophylaxis.

73 - **The Control of Parasitic Flies on Sheep in Australia by Spraying with Insecticide** (1). — MCDONALD A., H. E. in *Agricultural Gazette of New South Wales*, Vol. XXX, No. 6, pp. 403-405, 3 fig. Sydney, June, 1919.

Experiments carried out at Trangie Experiment Farm, New South Wales, Australia, with the object of confirming the efficacy of spraying insecticides on sheep (by forcing a strong jet of the liquid into the wool) as a measure of protection against the blow fly or blue-bottle fly (*Calliphora* spp.), show that, although this treatment does not give complete protection, it, however, reduces considerably the number of sheep attacked since, on the average, the proportion was 33 % in the flocks treated and 54 % in the untreated flocks.

The insecticides used in the experiments were an arsenical sheep-dip powder, a carbolic dip and a mixture in which the active agent was arsenite of soda. All were applied by means of a very strong jet with a diameter of about ¼ inch, using a pressure of about 60 lb. During the treatment the wool was not clipped because it was required to hold the insecticide and to enable the maggots present in the wood to be poisoned. The application was repeated a second time 6. weeks later.

It appears that this treatment localises attacks, but further research is necessary.

74 - **Efficacy of Leguminous Plants of the Genus *Deguelia* (= *Derris*) in Fighting Parasitic Insects and Mites in Domestic Animals.** — See No. 143 of this *Review*.

75 - **Diseases of Pigs in Albania.** — See No. 99 of this *Review*.

76 - **The Acid-Base Balance in Animal Nutrition; Metabolism Studies on the Effect of Certain Organic and Mineral Acids on Swine** (2). — LAMB, A. R. and EVVARD J. M. (Iowa Agricultural Experiment Station, Ames), in *The Journal of Biological Chemistry*, Vo. XXXVII, No. 2, pp. 329-342. Baltimore, Feb., 1919. FEEDS AND FEEDING

Metabolism studies undertaken by the authors on live pigs to obtain definite information regarding the transformation of lactic, acetic and sulphuric acids in the body of the animal to which they were fed.

RESULTS. — With a ration containing an abundance of calcium the animal apparently oxidised the organic acids completely without increase of ammonia in the urine, and these acids apparently caused a slight increase in the retention of calcium.

With the same basal ration plus 300 cc. of normal sulphuric acid solu-

(1) See also *R.*, Nov. 1914, No. 1017 *R.*; April 1915, No. 401 and *R.*, Oct. 1915, No. 1051; *R.*, Dec. 1916, No. 1295; *R.*, Dec. 1918, No. 1874. (*Ed.*)

(2) See *R.* April, 1919, No. 485. (*Ed.*)

tion a day, 61 % of the acid ingested was neutralised by the ammonia excreted and 5 % was excreted as phosphates.

With another basal ration, very poor in calcium, extra ammonia excretion accounted for 76 % of the ingested acid and extra urinary acidity for 10 %.

With neither of the above noted rations did the mineral acid cause a significant loss of calcium, nor did it interfere with the storage of protein.

77 – **Vitamines in Green Fodder.** — Osborne T. B. and Mendel, L. B. with the cooperation of Ferry, E. L. and Wakeman, A. J. in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 1, pp. 187-200, 3 pl. Baltimore, Jan, 1919.

The authors have studied the presence in certain green plants, of fat-soluble and water-soluble vitamines by means of feeding tests on rats. In order to test for each of these vitamines, the product under study was fed in a ration rich in the other kind of vitamine. The following vegetable foods were tested :— leaves and stalks of spinach ; whole inside leaves of cabbage ; whole young plants of alfalfa, clover and timothy grass ; after drying in the air at 50-60°, then finely ground.

The results obtained indicate that 10 % of spinach furnished a little less than the required amount of water-soluble vitamine, while the rats obtained abundance (for normal development) of fat-soluble vitamine ; 145 % of cabbage leaf appears to be equivalent to about 10 % of spinach in respect of water-soluble vitamine. Preliminary experiments with the other plants indicate that the content in water-soluble vitamine of clover and timothy grass is similar to that of cabbage, while alfalfa is a little richer. The content of fat-soluble vitamine appears to be very high.

According to the few data at present available, green vegetables supply an important addition to human diet, because the staple foods (cereals, potatoes, sugar, meat, fats, etc.) furnish too limited a quantity of either of these vitamines to satisfy wholly the requirements of an adequate diet.

78 – **Supplementary Relationships between the Proteins of Certain Seeds.** — Mc Collum, E. V., Simmonds, N., and Parsons H. T., in *The Journal of Biological Chemistry*, v. XXXVII, No. 1, pp. 155-178, 7 diagr. Baltimore, Jan., 1919.

Study of the values of different mixtures of proteins furnished by 2 seeds, one of which (linseed or millet) furnished $\frac{1}{3}$ and the other (barley, wheat, maize pea, kaffir corn, soya bean, rolled oats, cottonseed flour, rye) furnished $\frac{1}{2}$ of the total protein of the food mixture. The total quantity of protein fed represented 9 % of the dry food mixtures. Records were made of the growth and variations from normal in ordinary functions of the adult animal (rats), such as reproduction and nursing the young. Individual differences of vitality were compensated by data being obtained from a group of 4 or 5 animals fed at the same time and with the same rations.

Results. — Generally, the proteins of the two seeds did not supplement each other to any appreciable extent.

The best growth curves were obtained with a mixture of linseed (furnish-

ing 1/3 of the protein) and rye (furnishing 1/3 of the protein), and with a mixture of pea (furnishing 1/4 of the protein) and millet (furnishing 1/3 of the protein).

Reproduction was better, in all cases, with a mixture of proteins from the 2 seeds than with protein furnished by one seed only.

79 – **The Nutritive Value of Coconut Globulin and Coconut Cake.**— JOHNS, C. O., FINKS, A. J., and PAUL M. S. in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 4, pp. 497-502, 4 diagr. Baltimore, Apr. 1919.

Coconut cake is chiefly used for feeding milch cows to obtain milk with a high fat content. The consumption of the cake has increased enormously during the last few years in the United-States. During the financial year ending June 30, 1918, 486 996 112 lb. of copra were imported into the United States ; this was four times as much as the quantity imported in 1916. Coconut oil is used to a great extent in the manufacture of oleomargarine ; the cake contains about 10 % of oil and from 17 to 18 % of protein, composed chiefly of globulin which contains about 17.5 % of nitrogen and the following percentages of amino-acids : — Cystine 1.44, arginine 15.92, Histidine 2.42, Lysine 5.80, that is to say all the amino-acids necessary for growth as well as tryptophane.

The chemical composition of the protein of the coconut showed that it was of high quality and feeding tests made by the authors (on rats) have fully confirmed this.

It has been proved that : — (1) The globulin of the coconut produces normal growth when used as the sole source of protein in an otherwise complete diet.

(2) Commercial coconut cake furnishes the necessary amount of protein for almost normal growth.

(3) This cake contains sufficient water-soluble vitamine and also some fat-soluble vitamine, but the rate of growth is increased by adding butter fat to the ration.

80 – **Importance of Salt in Food Rations of Cattle.** — JOFFE, J. in *Journal of Dairy Science* Vol. II, No. 3, pp. 159-169, bibliography of 8 titles. Baltimore, May, 1919.

The author purposed to review the literature on this subject, to bring to light the opinions put forward recently on the matter and if possible to draw practical conclusions from them. These conclusions may be summarised as follows : — Want of salt in the rations causes pathological conditions and gives rise to a loss of live weight and of vitality and, consequently, a decrease in yield. The experimental data worked out by the author indicate that the necessary amount of salt, according to the rations, should vary between 36.6 gm. and 40. 7 gm. per day for each milch cow in the cowhouse. Some foods, such as soya beans and Kafir corn (a variety of sorghum) require a larger amount of salt. At the Agricultural Experiment Station of Kansas only salt obtained by evaporation is used, rock salt being too coarse and irritating.

BREEDING

81 – **Colour Inheritance in Mammals.** — Wright, S. in *The Journal of Heredity*, Vol. VIII, No. 5, pp. 224-235 ; No. 8, pp. 373-378 ; No. 9, pp. 426-430 ; No. 10, pp. 473-475 and 476-480 ; No. 11, pp. 521-527 ; No. 12, pp. 561-564 ; Washington 1917 ; Vol. IX, No. 1, pp. 33-38 ; No. 2, pp. 87-90 ; No. 3, pp. 139-144 ; No. 5, pp. 227-240. Washington, 1918.

I. — The author attempts to establish relationship between biochemical discoveries relating to melanism and the correlations between different colours described in works on genetics. He proposes a scheme by which the reciprocal relations between the different colours of the cost of mammals can be indicated and he recommends the following classification of colour factors :—

(1) Factors which influence distribution and intensity of colour, largely irrespective of the kind of colour : —

a) Factors which influence the distribution of colour in contrast with white ;

(*b*) Factors which influence the intensity of colour in all coloured parts of the skin, fur, and eyes.

(2) Factors which influence the distribution and the intensity of differentiation from yellow to black, effects naturally visible only in coloured parts : —

(*a*) Factors which influence the distribution of a dark colour (black, sepia, brown, etc.) in contrast with yellow ;

(*b*) Factors which influence the intensity of only the dark colours with effects visible whereever these colours appear (skin, fur, eyes).

II. — Mice. — The author states in detail the present state of knowledge relating to colour inheritance in these animals. He gives a list of 7 sets of Mendelian allelomorphs which have been identified and of 3 sets of colour variations which have not yet been analysed. These are classified according to their physiologically visible effects in conformity with the previously mentioned scheme.

III. — Rats. — Data regarding colour inheritance in rats consist chiefly in the interpretation of results of selection experiments on hooded rats (grey with black head and narrow mid-dorsal stripe) carried out by Castle, W. E., *American Breeders Magazine*, No. 3, pp. 270-282 ; 1912 ; *American Naturalist*, Vol. 48, pp. 65-73, 1914 ; Vol. 49, p. 37 and Vol. 713-726, 1915 ; Vol. 51, pp. 102-114, 1917 ; Castle W. E. and Wright S., *Sci. N. S.*, Vol. 42, pp. 191-195, 1915 ; Castle W. E. and Phillips, J. C., *Carnegie Institution Washington Publication* No. 195, 56 pp., 1914 ; Castle, W. E., *Ibidem Publication* No. 241, part iii, p. 161-187, 1916.

The author concludes that genetic variations occur sufficiently often to give a basis for selection which might be carried on indefinitely. " Under any interpretation Castle's, selection experiment demonstrates the efficacy of Darwinian selection. It is true that one large mutation occurred with effects perhaps as great by itself as the entire plus selection series, but where such a variation gives one new level, selection has produced a continuous series of stable levels. This would give selection of small variations a more important place in evolution and animal husbandry, where it is nice adjustments of one character to another or to the environment, that count ".

IV. — Rabbits. — The author enumerates the 10 unit differences known to exercise influence in colour inheritance in rabbits. These are classified in 7 independent sets of allelomorphs, of which 3 have been proved to be triple allelomorphs. These 3 sets of allelomorphs, as in the case of many other mammals, determine a linear series of physiological effects which are inexplicable as linkage of factors in the germ cells.

V. — Guinea pigs. — In the guinea-pig, as certainly in other animals, the spots on the coat must be determined by a collection of causes of very diverse kinds. There are hereditary factors of many kinds and factors which are of the nature of accidents happening during development. Certain factors influence the development of the spots and others determine their position. Of the latter, some assign the spot to the axis of symmetry and organs of the body others determine the position at random. Some factors influence only the tortoiseshell or the piebald coloration in one way or another, while others have a simultaneous influence on both. The result is such a diversity of pattern among tri-coloured animals, that a rough sketch will *identify* almost any animal in a group of a thousand.

VI. — Cattle. — The author, considering the inheritance of the colour roan, maintains that the data furnished by Wentworth (*American Breeders Magazine*, No. 4, pp. 202-208, 1913 — *Journal of Agricultural Research* Vol. 6, pp. 141-47, 1916) do not confirm the 2 factor hypothesis enunciated by that writer, but rather the idea of a single factor without dominance ; he explains the exceptions by means of subsidiary hypotheses. The results published by Lloyd-Jones and Evvard (*Research Bulletin* No. 30 *Agricultural Experiment Station Iowa State College of Agriculture*, 1916), showing that white is independent of red and of black are regarded as contrary to the theory of "polygamous factors" (multiple allelomorphs) enounced by Wilson (*Sci. Proceedings of the Royal Dublin Society*, p. 11, 1918) to explain the roan coat.

Contrary to Wilson (*Sci. Proceedings of the Royal Dublin Society*, pp.12-66, 1909), the author considers that the colour dun (dull brownish black ; the hairs showing a yellowish tip and the yellow colour tending to predominate especially along the mid-dorsal line) is due to a diluting factor combined with black. The same factor combined with red produces yellow or cream. Brindling (that is to say the presence of irregular black streaks, or of a deeper black if the ground colour is black also) has not been analysed in a satisfactory manner. Piebald is independent of colour, but, on account of the few data available, the interpretation of the factors of the different spots cannot be attempted.

VII. — Horses (1). — In these animals 7 pair of independent allelomorphs are recognised. Generally the works of the different writers supplement and confirm each other. The author is unable to explain certain facts exhibited by horse hybrids, especially the occurrence of chestnut mules since that colour has never been seen in the ass and is recessive in the horse.

VIII. — Pigs. — The author collects the fragmentary data published

(1) See *R.*, Dec., 1917, No. 1188. (*Ed.*)

on the subject of colour inheritance in these animals. White in Yorkshires is dominant over red and over black as has been shown by SMITH (*American Breeders Magazine*, No. 4, pp. 113-123, 1913), but it differs from the dominant white of other mammals inasmuch as that breed never transmits red when crossed with black, nor black when crossed with red. The author puts forward the idea that, in the case of Yorkshires, white is an extreme dilution of red accompanied by complete absence of extension of black.

The absence of the factor of dilution and the presence of a partial extension of black gives as result a black coloration with the white points of Berkshires and Poland Chinas. A change in minor factors causing an intensity of red and a restriction of black transforms this colour into self red in Duroc Jerseys and in Tamworths. The replacing of the factor " partial extension of black " by the factor " total extension " gives as result a self black coat as in the Essex breed, while the addition of the factors of the white band has for result the coat of the Hampshire breed.

IX. — DOGS. — For the colour of the coat, 5 pairs of unit characters have been more or less clearly distinguished.

X. — CATS. — The most curious fact regarding colour inheritance in these animals is that tortoiseshell fur (yellow mixed with black) is rarely found in males.

The theories put forward to explain it assert that an orange male crossed with a black female will only produce black males and tortoiseshell females. Tortoiseshell females crossed with orange males should produce black males and an equal number of tortoiseshell and orange feamles.

However, in both crosses only black females and tortoiseshell males were registered. The author notes that these discrepancies are much more numerous among the female than among the male descendents and, consequently, the variations cannot be left out of account as errors in the record. It appears that, for colour inheritance in the fur of cats, there are 7 pairs of well-defined allelomorphs.

XI. — MAN. — The author sums up briefly the data available on the subject of colour inheritance for the hair, the colour of the eyes, premature grayness, albinism and locks of white hair.

HORSES

82 – **French Horses in America, especially in the United States.** — GRAU, ALFRED, in *Journal d'Agriculture pratique* Year LXXXIII, No. 40, pp. 808-812, 2 figs. Paris Nov. 6, 1919.

It seems most probable, that, among the French breeds of horses, the draught, and particularly heavy draught, breeds will come to the front, owing both to their less delicate constitution, and the greater success in their production, and of their more ready and advantageous sale.

French breeds of draught horses have long been universally appreciated; in America, and in the United States in particular, they are the most appreciated. This is a very interesting fact for French export.

Americans prefer quiet and powerful animals, as large and heavy as possible.

Whether from the drier climate, or for some other reason, these breeds,

once they have been exported to North America, have a tendancy to fine down, and to decrease in weight and size at the end of several generations; for this resason, it is necessary to renew the blood frequently by good sires.

Among the draught breeds in France, some, such as the Nord and Ardennes draught horse, have suffered much from the war, and it will take time and much trouble to restore them, but these will not be lacking.

Compared with these breeds, the others such as the Boulonnais, Percheron, Nivernais breeds, the mule producing breed of Poitou, the Breton draught horse have not suffered.

In the United States, out of 100 horses, 82 are Percherons, 12 Belgian and only 5 or 6 English heavy draught Clydesdale or Shire stallions.

French breeds have the greatest future in America, and it is incumbent on France to continue her efforts, especially as regards selection.

CATTLE

83 - **French Cattle in Brazil.** — De la Vaissière, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 29, pp. 780-781. Paris, Oct. 1, 1919.

M. A. Crozier, (Directeur de l'Office National du Commerce Extérieur), transmits a report of the author, French vice-consul, at Porto-Alegre, on the possibilities of export of French cattle to Brazil.

Great efforts are being made, under the auspices of Dr. C. Dillon, H. B. M. Consul at Porto-Alegre, to group the breeders of stud animals in the United Kingdom, with the object of establishing a flow of export of the above mentioned animals towards the Rio-Grande-du-Sul, as was done for many years for the Argentine Republic.

From the standpoint of cattle which hold the first place in the breeding of that part of Brazil the breeds which are most interesting are the Flemmish (red coat) the Normandy, and also the Charolais. There is, therefore, a good market there for young bulls and heifers of the above-mentioned breeds, and the author draws the attention of French breeders of stud animals to this question.

84 - **Milk Substitutes in Feeding Calves.** — Caldwell, R. E., in *Journal of Dairy Science*, Vol. II, No. 4, pp. 312-329, 15 fig. Baltimore, July, 1919.

In the United States milk and its products supply about 19 % of the food consumed by man in normal times; it is therefore essential to find adequate substitutes for feeding calves This question has been studied for 5 years at Purdue University Agricultural Experiment Station.

The experiments described in the work under review served to compare the utilisation of nitrogen in 3 rations, one containing liquid blood, the second vegetable protein and the third milk only.

A calf (No. 1) received milk, ground maize, oats and clover hay. The milk was replaced by a mixture of 1 part (by weight) of linseed meal + 1 part of " red dog " flour + 1 part of hominy + 4 parts of liquid blood. When the calf was 116 days old, it was given a ration which only differed from the former by containing dry instead of liquid blood and the 4 ingredients in the milk substitute were in equal parts.

A second calf (No. 2) received milk and a dry mixture of 5 parts of ground

maize + 5 parts of gluten feed + 5 parts of "red dog" flour + 2 parts of buckwheat flour and clover hay as roughage.

The milk was later replaced by a mixture of the same ingredients composing the dry mixture with the addition of an extract obtained by boiling clover hay in water until the liquid portion contained 1 per 1000 of nitrogen. When this calf was 110 days old he was placed on the same ration as calf No. 1 in the first part of the experiment. Two other calves (Nos. 3 and 4) received milk, ground maize, oats and alfalfa hay. They served as control to the two preceding calves. When calf No. 3 was 100 days old, it was given the ration which was fed to calf No. 2 during the first part of the experiment. When calf No. 4 was 90 days old, it received the ration which had been fed to calf No. 1 during the first part of the experiment. The 4 bull calves were of the Holstein breed.

All the calves were placed in digestion crates; the quality and quantity of their excreta were recorded daily. The calves were weighed every 10 days and photographed every 30 days.

A series of tables indicate: — The consumption of nitrogen and the percentage of nitrogen which each feed supplied for each of the 4 calves; the quantity of nitrogen fed to, excreted and retained by each calf; the gain in live weight every 10 days (on the average, the daily gain was 1.15, 0.68, 1.08, and 1.81 lb. respectively for the four calves).

The amount of nitrogen fed in the food increased, for calf No. 1, from 39.192 gm. per day between the 20th and the 30th day of age to 114.595 gm. between the 130th and the 140th day, with a maximum of 115.100 gm. and there was, during the 120 days above noted, a total of 11138.710 gm. and, on the average, 92.822 gm per day. The respective figures for the other calves were: — *Calf* No. 2, from 38,354 gm. between the 1st and the 10th day of age, to 66,118 gm. between the 110th and the 120th day, with a maximum of 72.025. gm. total for the 120 days 6451.910 gm.; daily average 53.766. gm.

Calf No 3, from 27.942 gm. between the 20th. and the 30th. day of age to 67.944 gm. between the 130th day and the 40th day, with a maximum of 83.808 gm.; total for the 120 days 7289.240; daily average 60.745 gm. — *Calf* No. 4 from 11.458 gm. between the 20th and the 30th day of age, to 75.541 gm. between the 130th day and the 140th day; with a maximum of 87.232 gm. total for the 120 days 5784.69 gm.; daily average 48.205 gm.

The percentages of nitrogen excreted in the faeces of the 4 calves on the average for the 120 days of the experiment, were 34.24, 28.73, 31.07, 25.57, respectively, those for nitrogen excreted in urine were 42.16, 31.52, 31.00 and 36.12, those for nitrogen retained were 23.76, 28.81, 37.84, and 39.15.

Calf No. 1, which received animal protein in the form of liquid blood, consumed the greatest amount of nitrogen, retained less and excreted more in the form of urine than any of the other calves in the experiment. But the effective amount (in grammes) of nitrogen retained was equal to the average for the two calves fed on milk.

The excess nitrogen eliminated in the urine shows that the nitrogen

supplied by the liquid blood has high degree of solubility or absorption and serves as a guide, at least in some measure, in judging the desirability of a ration for calves. When calf No. 1 received dry blood instead of liquid blood, the amount of nitrogen consumed remained fairly constant, the retained nitrogen was equal to that previously retained and the excreted nitrogen changed from the urine to the faeces.

Calf No. 2, which received the vegetable protein ration, consumed a small quantity of nitrogen, retained the smallest quantity in grammes, and excreted the largest quantity in the faeces. The presence of milk or liquid blood increased the nitrogen in the urine to a point which agrees very closely with that given by the calves which received these foods.

Calves Nos. 3 and 4 retained the largest amount of nitrogen and maintained a more equal division of nitrogen elimination in the faeces and in the urine than the calves which received the substitute ration. Their behaviour when changed to other kinds of rations agreed with that of calves which received similar rations during the earlier periods of the experiment.

85 – **Can "Home Grown" Rations Supply the Proteins Necessary for High Milk Production?** — HART, E. B. and HUMPHREY, G. C., in *The Journal of Biological Chemistry*, Vol. XXXVIII, No. 3, pp. 515-527. Baltimore, July, 1919.

A ration composed of cereal grains, silage and clover or alfalfa hay is considered by some as sufficiently adequate in protein content for maintaining a high milk production. But in view of the new theory according to which the value (for growth or milk production) of a protein mixture depends upon its qualitative constitution and its quantitative composition and not merely on the quantity of proteins fed, it was necessary to determine directly by metabolism experiments whether the above-mentioned ration, entirely produced on the farm, could furnish protein for a high milk production without draining the protein reserves in the tissues of the animal. The ration used in the experiment was composed of maize stalk silage and clover hay to which ground oats were added in the 1st. period of 4 weeks, ground barley in the 2nd. period, ground maize in the 3rd. a mixture of approximately equal parts of the three grains in the 4th. period, all periods of 4 weeks. The amount of energy provided by the 4 rations was maintained constant by the addition of maize starch. The proportion of grains and starch fed to 3 cows (Nos. 1, 2 and 4) was in conformity to the rule 1 lb, of grain for 3 lb. of milk ; that of grains fed to 2 cows (Nos. 3 and 5) was larger than the normal.

The cows belonged to the Guernsey, Jersey and Holstein breeds. Cows Nos. 1 and 3 were good milk producers for they gave 34 to 37 pounds of milk daily when the experiment commenced. Although these cows were fed *ad libitum* they had a negative nitrogen metabolism from the beginning of the experiment for 5 or 6 weeks, during which time their milk production decreased gradually to a point where the ration consumed maintained a state of nitrogen equilibrium, which was reached before the end of the second period of 4 weeks.

Cow No. 1, during the 8 weeks when she was put on a ration of oats fol-

lowed by barley, decreased the amount of nitrogen secreted in the milk by over 100 gm. per week ; this quantity decreased by over 150 gm. per week in the case of cow No. 3. On December 3, cow No. 1 produced 33.8 lb. of milk and on February 3, only 23.7 lbs. cow No. 3 gave 36.9 lb. on December 3 and 25.9 lb. on February 3. Cow No. 2 consumed a large amount of food but she gave less milk than cows Nos. 1 and 3, which enabled her to maintain herself in nitrogen equilibrium on the grain ration + silage + clover hay. The amount of nitrogen secreted in the milk produced by her during a week scarcely decreased by 60 to 70 gm. ; the quantity of milk was also sensibly maintained ; it varied only from 23.7 lb. on December 3, to 20.1 lb. on March 17. These results show clearly that ordinary " home grown " foods suffice only for a moderate milk production. The data set forth in the Table below confirm the conclusion that the essential change incident to an intake of protein insufficient both in quantity and quality for nitrogen equilibrium in a milking cow is a rapid decrease in the secretion of milk and not a change in the percentage composition of the milk.

Decrease in quantity of milk produced by cows in negative nitrogen balance, but maintaining the percentage composition of the milk.

	Cow No. 1		Cow No. 2		Cow No. 3		Cow No. 4		Cow No. 5	
	Dec. 16	Jan. 13	Dec. 16	Mar. 10	Dec. 16	Jan. 13	Feb. 10	Mar. 10	Feb. 10	Mar. 10
Milk daily . . . . . lb.	32.7	26.8	24.3	21.2	32.6	26.0	32.9	19.6	31.3	23.0
Total solids . . . . . %	13.57	13.52	14.27	14.17	13.07	12.73	10.96	11.90	12.07	12.58
Fats. . . . . %	4.60	4.45	4.70	5.10	4.10	3.50	2.80	3.50	3.10	3.60
Nitrogen. . . . . %	0.49	0.47	0.53	0.53	0.46	0.47	0.41	0.48	0.50	0.49

The mixture of oats, barley and maize was not better than rations containing a single grain. During the period of observation the live weigh of the animals gave no indication regarding their nitrogen equilibrium. Cows Nos. 1 and 3 lost heavily in weight under conditions of negative nitrogen balance : they changed respectively from 1024 to 935 lb. and from 885 to 762 lb. between December 2, and January. 20.

Cow No. 2 which was in nitrogen equilibrium during the 16 weeks of the experiment did not lose weight but did not increase appreciably for she changed from 1088 lb. on December 2 to 1199 lb. on March. 27 Cows No. 4 and 5, although in negative nitrogen balance during 4 or 5 weeks increased in weight respectively from 1356 to 1395 lb. and from 1135 to 1200 lb. between January 20 and March 17.

The animals in negative nitrogen balance decreased their production of milk by 8 to 10 lb. in 5 or 6 weeks : this amount would have a market value of about 50 cents.

The cost of the addition of 2 lb. of protein concentrates to the daily ration would therefore have been more than covered.

Conclusion. — A cow with a low milk production and a good appetite can be kept in nitrogen equilibrium with a " home grown " ration, but a good milk producing cow requires a supplement of protein concentrates to avoid loss of nitrogen and consequent decrease in the milk production.

86 - **Alfalfa as Sole Food of Dairy Cattle in the United States.** — Woll, F. W., in *Journal of Dairy Science*, Vol. I, No. 6, pp. 447-461. Baltimore, March, 1918.

The two most important changes in American agriculture during the past 25 years are the introduction of the silo in cattle farming and the introduction or the extension of alfalfa cultivation. The silo has spread from the east westwards and alfalfa from the west eastwards. At the present time alfalfa occupies over 30 % of the irrigated area of the United States and 7 % of the entire area under hay and fodder crops. The proper utilisation of a crop of this importance becomes therefore a most important economic problem both for the individual farmer and for the community. Furthermore, the fact that a very large number of farmers in the western States practise the method of feeding cattle exclusively with alfalfa has raised the question whether this practice is really the most economical. The author's research, carried out during more than 3 years at the California Agricultural Experiment Station, aimed precisely at clearing up this point and it was purposed to relate and discuss tbe principal results that have been so far obtained. The experimental data at present include 9 lactation periods for heifers fed, since the experiments began, exclusively on alfalfa, and 9 lactation periods for heifers of similar age, breed, etc., fed on rations of alfalfa hay, silage, and mixtures of various concentrates (mainly rolled barley, dried beet pulp, coconut meal, and wheat bran).

The influence of the two methods of feeding has been studied from the following standpoints : — Increase in live weight and body measurements during the tests ; the influence on the calves produced the heifers; the influence on the production of milk and butter during each lactation period ; the relation between the food consumed and the dairy production.

Influence on live weight and measurements. — The average gains in live weight were greater with mixed rations than with alfalfa alone, in both series of tests ; with the farmer the average gain was 1.11 lb. before calving as compared with 1.05 lb. for alfalfa alone ; during the entire period, the average increase was 0.60 lb. against 0.50 lb. per day, respectively, an average difference of 20% in favour of the mixed ration.

These results clearly indicate the nutritive superiority of the mixed ration compared with that of alfalfa alone, at least so far as gain in live weight is concerned. The increases in measurement were expressed in percentages and the figures recorded for both series in the period before calving and during the 1st and 2nd lactation periods were higher for the animals fed on mixed rations than for those which only got alfalfa. However, these differences disappear when longer periods or summary data for both lots are considered, except, however, the two measurements relating to length and girth. While these results are not conclusive, they

indicate a tendency towards a greater body development with mixed rations than with alfalfa only.

INFLUENCE ON THE CALVES DROPPED BY THE HEIFERS. — Since the beginning of the experiments there were 2 lots of 13 calves each comprising 6 Jerseys and 7 pure-bred or grade Holsteins. The calves dropped by the heifers fed on alfalfa weighed, on the average, 59.8 lb. at birth and those dropped by heifers on mixed rations averaged 64.4 lb, an average increase of 8 % for the latter. The experiments are at present insufficient to predict whether this difference will be maintained later with the growth of the calves, but a higher live weight at birth is itself a factor favourable to the future growth of a young animal.

INFLUENCE ON DAIRY PRODUCTION. — The animals under experiment have furnished up to date complete records of production and food con-

Food consumption and production, 1914-917.

	Length of the lactation period	Yield per lactation period			Average live Weight	Food consumption				
		Milk	Butter fat	Fat		Alfalfa hay	Green alfalfa	Silage	Green Maize	Grain
	days	lb.	lb.	per cent	lb.	lb.	lb.	lb.	lb.	lb.
LOT I.										
1st lactation period										
Fayne (pure Holstein)	364	8850.0	265.28	2.99	1267	9079	6065	—	—	—
Jap (pure Jersey)	365	5010.2	251.09	5.01	792	7870	7853	—	—	—
Begonia 2nd (id)	277	2670.1	121.44	4.55	861	5864	7883	—	—	—
Maria (Gr. Holstein)	316	6021.1	197.70	3.28	1064	7904	3982	—	—	—
Fairie (id)	382	6467.7	217.45	3.36	940	9692	4451	—	—	—
Babette (id)	395	5435.5	172.20	3.17	1017	7312	4234	—	—	—
Averages	335	5743.1	204.19	3.56	1007	7954	5745	—	—	—
2nd lactation period										
Fayne	345	8216.8	258.64	3.15	1334	8677	4069	—	—	—
Jap	368	5221.3	301.76	5.78	891	9402	5956	—	—	—
Begonia 2nd	348	5678.4	297.09	5.23	925	8894	5072	—	—	—
Averages	354	6372.2	285.83	4.48	1050	8991	5032	—	—	—
LOT II.										
1st lactation period										
Bess III (pure Holstein)	284	5978.6	166.68	2.79	1312	4808	2452	6299	629	673
University II (pure Holstein)	366	9907.0	352.62	3.56	1169	6285	3055	7692	—	2881
Mermaiden II (pure Jersey)	399	7070.1	346.63	4.91	818	5232	7509	5958	1214	2238
Nora (id)	368	6548.0	337.21	5.15	877	4818	7458	5381	934	2590
Duchess (Gr. Holstein)	351	7691.5	262.16	3.41	1110	5345	2380	7528	—	2366
Paula (id)	359	6961.0	317.01	4.55	1057	5395	2380	8056	195	2260
Averages	355	7359.4	297.05	4.04	1057	5314	4206	6819	495	2168
2ud lactation period										
University II	176	4702.4	167.39	3.56	1448	3200	2422	2535	175	1122
Mermaiden II	363	10136.7	519.86	5.13	909	6659	3055	8611	—	3955
Nora	368	7419.7	367.23	4.95	1037	5901	3055	7586	—	2786
Averages	302	7419.6	351.49	4.74	1131	5253	2844	6244	58	2021

sumption for 12 first lactation periods and 6 second lactation periods. The following Table shows the average production during the experimental period and the amount of food consumed. It will be noted that the mixed rations have proved decidedly superior to alfalfa alone so far as the production of milk and butter is concerned.

The average content of dry matter in the alfalfa rations was 24.9 lb. and in the mixed rations 28.6 lb; the nutritive ratios were 1 : 3.7 and 1 : 5.3 respectively.

For every 100 lb. of dry matter supplied in the ration of alfalfa alone, 70.7 lb. of milk and 2.82 lb. of butter were produced, against 79.4 lb. and 3.50 lb. respectively per 100 lb. of dry matter supplied in the mixed rations, an improvement in the latter over the former of 12 per cent. in the milk production and of 23 in the production of butter.

The explanation of these facts should be looked for in the number of calories furnished by the 2 rations. On the basis of the values given by ARMSBY, the alfalfa ration furnished 2.05 lb. of digestible protein and 9.9 calories, against 2.08 lb. of digestible protein and 15.4 calories for he mixed rations.

If the problem is considered from an economic standpoint, the practical results of feeding dairy cows may vary according to locality and the prices of foods. Taking the following prices of foods:—

Alfalfa hay, $2 per ton; green maize and green silage, $3; maize silage, $4; concentrates, $30; the cost for the 1st and 2nd lactation periods would be $56.34 and $61.49, respectively, using alfalfa alone, and $74.51 and $87.71 respectively for mixed rations an increase of $28.17 for the 1st lactation period and of $26.22 for the 1st. In these latter years farmers could not get a higher price than $8.00 per ton for alfalfa hay in stack, when concentrates cost $20 to $30 per ton. Evidently, under these conditions there is no gain in changing from the alfalfa ration to the mixed ration.

The problem can only be solved case by case, especially as there are plenty of examples of excellent results obtained by feeding with alfalfa alone. One herd of 23 stall-fed cows under test by one of the Cow-Testing Associations gave a general average of 410 lb. of butter fat on no other food but alfalfa throughout the year. However, it remains an established fact that mixed rations have an absolute superiority in the matter of production and growth, even if the superiority is only relative from an economic standpoint.

87 – **Relationship between the Quality of Proteins in Foods and Milk Production of Cows** (1) .— HART E. B. and HUMPHREY G. C., in *The Journal of Biological Chemistry*, Vol. XXXV, No. 2, pp. 367-383. Baltimore, Aug., 1918.

Two Guernsey cows and one Jersey were used in the experiments described in this paper. The daily production of milk of the 3 cows indicated by Nos 1, 2 and 3 was 22.00, 28.00, 24.20 pounds respectively. The ration was made up of 14 % of alfalfa hay, 56 % of maize stalk silage,

(1) See *R.*, Aug., 1915 No. 834. — *R.*, Aug., 1918, No. 888. (*Ed.*)

12 % of maize meal, and 18% of a mixture of starch and supplementary food. The nutritive ratio of the ration was 1 : 8.4. Total protein represented 10 % of the dry matter; 50 lb. of the ration furnished 2.32 lb. of digestible protein, of which about 37 % came from the supplementary foods; the production energy varied from 20.59 to 20.76 big calories. The nitrogen balance during the whole period of the test which lasted 16 weeks, was always negative no matter what the supplement was. During the test the cows maintained their live weight, but there was a slight decrease in milk production. The percentage composition of the milk remained almost constant.

The efficiency of the various rations is shown in the following Table :—

Absorbed nitrogen used for milk production by cows fed on alfalfa hay with various concentrates.

Concentrate	Cow No. 1	Cow No. 2	Cow No. 3
Gluten feed (gluten and maize bran ground together) .	40 %	43 %	43 %
Linseed meal	40	47	39
Brewers' grain	51	53	50
Cottonseed meal.	35	42	28

Earlier studies by the authors (1) showed that gluten feed is distinctly inferior, for milk production, to linseed meal and to distillers grain as supplements for proteins to the ration "corn stover" (2) + maize meal; that, on the contrary, as supplement to the ration clover hay + maize meal, gluten feed is practically equivalent either to linseed meal or distillers grain; the experiments now dealt with show that as supplement to the ration alfalfa hay + maize meal, gluten feed is equal to linseed meal, superior to cottonseed meal and inferior to distillers, grain. Cottonseed meal with the ration alfalfa hay + maize meal was the least efficient of the supplements.

Distillers grain was the most efficient of the supplements, perhaps because it contains the embryo proteins. An equally efficient protein mixture might be obtained by adding 10 to 15 % of maize germ meal to gluten feed.

These results once again show the limited value of any classification of natural foods in respect of the efficiency of their proteins based on the determination of that nutritive value in a single food or in a single mixture of foods.

88 - **Water Requirements for Milk Production.** — McCandlish, A. C. and Gaessler, W. G., in *Journal of Dairy Science*, Vol. II, No. 1, pp. 4-8, Baltimore, Jan., 1919.

Experiments carried out at the Iowa Agricultural Experiment Station, United States, with the object of determining the amount of water

(1) "Corn stover" = maize plants without the ears. (*Ed.*)

(exclusive of what is naturally contained in the food) required for milk production during the hot dry summer months by cows fed with fodder harvested on the farm. The cows were watered twice a day; the quantity of water consumed was determined by weighing the animals before and after watering. The moisture in the foods was determined, the amounts fed were weighed. The general results are set forth in the Table below. Results similar to those of the writers, obtained at the South Dakota Agricultural Experiment Station by C. LARSEN, E. H. HUNGERFORD and D. E. BAILEY (1) show that for 100 lb. of milk produced. 432 lb. of drinking water is required and a total of 570 lb. of water (in drink and food) is needed.

Production of milk and consumption of water by 5 milch cows.

Breed	Duration of the trial	Average live weight	Milk produced	Fat produced	Water drunk per 100 lb. of milk produced	Water drunk + water in food per 100 lb. of milk produced	Water drunk + water in food per 100 lb. of dry matter consumed
	days	pounds	pounds	pounds	pounds	pounds	pounds
Jersey	50	834	972	44	320	512	506
Ayrshire	25	918	705	26	361	431	661
Ayrshire	15	1039	462	1	286	453	681
Guersey	50	1024	991	42	338	536	521
Holstein . . .	50	1224	875	34	424	678	518
Promedio. .	—	**1001.8**	—	—	**345,8**	**522**	**577.4**

CONCLUSION. — Water consumption is most important for milch cows. When a cow is fed on fodder and grain. about 350 lb. of water in the food are consumed per 100 lb. of milk produced and in addition about 200 lb. of drinking water will be needed; about 550 lb. of water will therefore be required per 100 lb. of milk produced during the summer months.

89 – **Dairy Cattle Feeding Experiments in Texas U. S. A.** — EWING, P. V., RIDGWAY, J. W. and DOUBT, W. A. in, *Texas Agricultural Experiment Station Bulletin*, No. 238, pp. 5-14. College Station, 1918.

I. — COTTONSEED MEAL V. GROUNDNUT FEED FOR MILK PRODUCTION. — Two lots of 6 cows each were fed alternately by the reversal method during four three-week periods on two grain rations, maize chop and groundnut feed (in the proportion 1 : 1) and maize chop and cottonseed meal (3 : 2). The cows when on the peanut ration produced 178.7 lb. more milk and 8.85 lb. more butter fat than they did on the cottonseed meal ration, but owing to the fact that about 50 % more protein supplement was consumed, the increased production was not profitable, since groundnut feed and cottonseed meal were purchased at almost exactly the same price.

(1) See R., June 1918, No. 666. (*Ed.*)

A third lot of 6 cows fed during the entire 12 weeks on maize chop, groundnut feed and cottonseed meal (6 : 3 : 2) produced 583 lb. of milk and 1.08 lb. of butterfat more than the other cows when on the cottonseed meal ration. The third ration was considered the most economical of those tested. It is held that, under Texas conditions, where proteins are generally cheaper than carbohydrates, the proper basis for comparing feeds is the percentage of total digestible nutrients and not the protein content.

II. — Comparison of methods of preparation of velvet beans for dairy cows. — The grain mixture used in this experiment consisted of corn bran, cottonseed meal and velvet beans (2 : 1 : 3) and the roughage of pasture. Each of four different ways of preparing the beans (velvet beans = *Macuna pruriens* var. *utilis*) was tested in rotation with 4 lots of 3 cows, each lot receiving beans prepared by a particular method for 20 days. The amount of grain fed in each period was the same. The milk produced by the cows, when the beans were fed whole, totalled 6337 lbs., when the beans were cracked, 6345 lb., when cracked and soaked in water, 6398 lb. and when ground, 6690 lb. The feeding of cracked beans soaked, and of ground beans was accompanied by an increase of 7 or 8 lb. of butter fat. The increase in milk resulting from grinding was about 57 gallons for a ton of beans which at 40 cents a gallon is worth $ 22.80. Since mills will often grind the beans for $ 2.50 a ton, and the grinding can be done on many farms for $5, the operation is deemed distinctly profitable. No differences in palatability apparently resulted from the various methods of preparation.

90 – **Winter Rations for Dairy Heifers in Missouri U. S. A.** — Eckles, C. H., in *University of Missouri College of Agriculture, Agricultural Experiment Station Bulletin* 158, pp. 3-54, 16 fig. Columbia, Missouri, 1918.

This bulletin compares 15 rations with reference to their value and economy in promoting growth of dairy heifers during the winter months, and is based upon 70 individual feeds and growth records of heifers. Seventeen of the animals were included in the light-fed group of heifers forming a part of a previous investigation (1). The others were used in a series of feeding experiments conducted annually each winter from 1913-14 to 1917-18. Of the total number of heifers 31 were Jersey, 34 Holsteins and 9 Ayrshires. One of the Jerseys and one of the Holsteins were used two seasons.

For each of the animals the following data are published : — Age at the beginning of winter feeding, average daily consumption of each feeding stuff offered, digestible crude protein and net available energy of the daily rations (based respectively upon the average figures published by Henry and Morrison and by Armsby), initial weight and height at withers, normal weight and height for animals of the same breed and age, daily gain in weight, total gain in height, and the gains in weight and height to be expected of similar heifers under normal conditions.

The Jerseys varied in age at the start from 6 to 20 months, the Holsteins from 7 to 21 months and the Ayrshires from 9 to 15 months. The feeding

(1) Summarised in *R.*, Oct. 1916, No. 1094. (*Ed.*)

periods were mostly 5 months. The data on normal growth are taken from those accumulated at the Missouri Station, of which a summary was given in article No. 1188 of the *International Review of the Science and Practice of Agriculture*, Oct.-Dec. 1919.

The combinations of feeding stuffs compared include: 1) Alfalfa hay alone; 2) alfalfa and silage; 3) alfalfa and maize; 4) clover hay and maize; 5) silage, alfalfa and maize; 6) silage, timothy hay and maize; 7) silage maize and cottonseed meal; 8) silage, timothy, maize, and cottonseed meal. A variety of different proportions of grain and roughage wes tested. It was found that animals fed a ration which resulted in heavy gain during the winter made only small gains the following summer on pasture. When the winter ration was so meagre that the animals were low in vitality in the spring fairly large gains were produced on summer pasture, but in most cases they were not large enough to compensate for the small winter gain. Neither extreme in winter feeding is considered economical. The best results, it is held, follow a winter ration that keeps the animal in moderate flesh and produces growth as nearly normal as possible. It was found that normal growth could be obtained from rations furnishing considerably less protein than that prescribed by the WOLFF-LEHMANN standard.

Of the 17 heifers wintered on alfalfa alone, only 2, both rather mature, made a gain in weight equal to normal. Although alfalfa is probably the most palatable roughage used for cattle in the United States and the quality fed was of the highest, still the animals did not consume enough to supply sufficient energy to allow for a greater growth.

The 15 heifers fed both silage and alfalfa made better gains than those fed alfalfa alone. The best gains occurred when both roughages were fed at will. On this ration animals more than 9 months old made practically normal gains. They consumed the silage and alfalfa in the proportion of 2:1. Younger calves needed grain in addition in order to grow normally.

The most satisfactory ration of all those tried was silage *ad lib.*, and legume hay limited to about 6 lb. daily and 2 lb. of maize daily. On this ration heifers of all ages throve and made gains somewhat above the normal.

Fair results may be obtained from silage alone for roughage, if legume hay is not available. In this case about 2 lb. of concentrates should be supplied daily, of which one half should be a high protein feed such as linseed or cottonseed meal, the remainder maize, or other grains if the cost is less a pound than for maize. The animals made better gains and seemed to be more contented if about 2 lb. of timothy hay per day was added to a ration of silage and grain.

Alfalfa or clover hay fed at will with 2 or 3 lb. of maize daily made a satisfactory ration for heifers of any age from 6 months to within a few weeks of freshening.

It is considered best to continue feeding grain to all heifers for a few months after the cessation of milk feeding. At a later age they can be fed exclusively on roughage if necessary without greatly retarding their

growth. It appears that Holsteins are able to make more nearly normal gains on a ration composed mostly of roughage than are Jerseys.

91 – **Winter Cattle-feeding Trials in Indiana, United States.** — SKINNER, J. H. and STARR, C. G. in *Purdue University Agricultural Experiment Station, Bulletin* No. 220, 26 pp., 1 fig. Lafayette, 1918.

With the object of following up previous work (1), relating to the study of the distribution of small rations of maize for fattening steers, and of making a comparison of the food values of silage composed of maize + soya beans and maize silage, a food test was made on 69 two-year old steers divided into 7 lots, lasting 120 days from December 13, 1917.

Lot IV received a medium ration of maize (12 lb. per head daily), except at the commencement of the trials. Lot III received half that amount and Lot I only got maize during the last 40 days of the trial. The steers were also given cottonseed meal to the extent of 2.5 lb. daily per 1000 lbs live weight, good maize silage and clover hay.

The three other lots were placed on a medium ration of maize ; two of them received in addition silage composed of maize + soya beans, and the third maize silage. This last lot and one of the lots which got silage composed of maize + soya beans received maize only as concentrate. The maize was of the same quality in the maize silage as in the silage composed of 2 parts maize + 1 part soya beans cut at the same time as the maize and when the pods were still green but with the beans well formed, and the leaves were beginning to turn yellow. The results are shown in the following Table :—

Results of the experiment.

Lots	Average daily ration of maize	Initial weight per head	Average daily gain in live weight per head	Pounds of food cousumed per pound gain in live weight					Selling price per cwt.	Profit per head (not including profit on pigs)
				Maize	Cotton-seed meal	Maize silage	Mixed silage	Clover hay		
	lb.	lb.	lb.						$	$
I	* 4.15	1050	1.77	2.34	1.58	26.8	—	2.26	14.85	34.62
II	—	1050	1.66	—	1.69	32.6	—	2.51	14.55	35.55
III	5.42	1036	1.87	2.90	1.52	24.4	—	2.48	14.85	32.88
IV	10.73	1047	2.40	4.48	1.21	16.0	—	1.79	15.35	39.85
V	10.73	1044	2.30	4.66	1.26	—	17.0	1.96	15.25	36.02
VI	11.65	1042	1.92	6.07	—	—	19.1	2.26	14.35	25.86
VII	11.65	1044	1.79	6.50	—	20.7	—	2.38	14.65	27.44

* Lot I was given no maize during the first 80 days

Maize was valued at $1.12 per bushel ; cottonseed meal at $53.50 per ton ; clover hay at $25.00 per ton and the two kinds of silage at $7.50

(1) See *R.* June 1918, No. 668 and *R.* Aug. 1918, No. 887.

per ton. At these prices Lot II gave the cheapest gain per unit of live weight and Lot IV was second, but considering the smaller gain in live weight and the less finished condition of the steers, Lot II was not so profitable as Lot IV. There was no noticeable difference in the two silages used. The comparison of Lots IV and V with Lots VI and VII respectively seems to prove that the omission of a concentrate containing protein diminishes the economy in live-weight gain, the degree of finish attained by the steers, and the gain per head.

Each lot of steers was accompanied by pigs. The authors give the quantity of grain which the pigs ate and the pork produced, but as different quantities of grain were given to the pigs in the different lots and, in some cases, they were given tankage in addition, it is not possible to make any exact comparison between the lots of steers regarding the profit derived by feeding pigs with them.

92 – **Uruguay Sheep.** — Wilson, R. B. (Jefe de la Oficina de Estadística agrícola), in *Rivista del Ministerio de Industrias, República Oriental del Uruguay*, Year VII, No. 47, pp. 343-380, 11 figs. Montevideo, 1919. SHEEP

It is not known when and where sheep were first introduced into Uruguay; according to certain writers, it was at the beginingof the XII th. century. The sheep introduced belonged to two distinct breeds, which even after centuries of neglect and degeneration, have preserved their typical characters: the first, which became known as the " pampa " breed was derived from the " churra " type from Spain, which in turn partly owed its origin to a cross with breeds of English wool producers ; the second was called " criolla ". The " pampa " sheep was valued for its production of wool and " criolla " used only for meat.

In 1842, 991 040 kg of wool was exported from Uruguay, and in 1862, 286 3061 kg., in 1870, 12545 400 kg. Since then progress has been very rapid and constant, as the figures of the following table show :

Export of sheep and their produce from Uraguay from 1876 *to* 1900.

Quinquennial periods	Live sheep	Skins with fleece	Wool
1876–1880	79 782	16 770 063 kg.	80 861 820 kg.
1881–1885	435 282	23 269 718	125 388 799
1886–1890	289 010	36 286 934	163 375 865
1891–1895	438 699	28 807 657	172 593 083
1896–1900	866 291	33 534 732	201 609 880

From the end of the XVIIIth century rams of different breeds were introduced from Spain, France, England, Germany, and Austria, to im-

prove the sheep of the country, but the majority, as the improving breed, was of the Rambouillet breed.

On the occasion of the 1st, "Congresso Ganadero Agricola" (Congress of Stock breeding and Agriculture) organised by the "Asociación Rural delUruguay" at Montevideo, in 1895, the following resolutions were passed:—

(1) To improve and increase the yield of wool and meat, the early maturing pure Rambouillet breed should be adopted.

(2) In surroundings suitable to English meat breeds, these breeds should be used to increase the yield of meat.

The census of 1900 showed for Uruguay a total of 18 068 717 head of sheep and an annual production of 32 749 381 kg. of wool, that is to say, on an average, 18.12 per head. In 1908, there were 26 286 296 sheep and the census made in April, 1916, (that is to say before the lambing season) showed only 11 472 852. This heavy decrease (56 %) of the total number of sheep had been foreseen since the export of wool from 1912 (80 940 342 kg.) to 1916 (30 602 061 kg.) had decreased by 62 %. After that the total increased and for 1919 the author estimates it at abont 15 million head.

In 1902 the "La Frigorifica Uruguaya" Co., Ltd., was founded, which, in 1905, began exporting frozen mutton to Europe. Its production increased from 100 432 animals killed in the season 1904-1905, to 314 041 animals in 1911-1912, and 225 724 in 1912-1913. There was then a sudden and very heavy decrease during the whole period of the war.

The "Frigorifico Montevideo" (Swift Company) began work in 1912-1913 and in each of the years 1913 to 1918 killed 160 301, 108 791, 105 600, 128 940, 46 659, and 39 199 animals respectively, of an average live weight varying during the several years of that period, between 48 kg. and 57.6 kg., figures corresponding to an average weight of from 23 kg. to 29.3 kg. per animal, cut up and prepared for sale.

The frozen mutton industry, in consequence, has had for result the breeding of a greater proportion of meat breeds (Lincoln and such-like) and a smaller proportion of Merinos, as will be seem from the following figures: —

Breeds	Numbers	
	in 1908	in 1916
Merinos	6070701	4363013
Lincoln and such-like (White face)	1039821	6723040
Shropshire and such-like (Black-face)	226559	327483
Other breeds	176917	—
Breeds not specified	17402833	—
Criolla	1370025	59316
Totals	26286896	11472852

93 - **Tripoli Sheep.** — See No. 128 of this *Review*.

94 - **Sheep Feeding in the United States** (1).— SKINNER, J. H., and STARK, C. G., in *Purdue University Agricultural Experiment Station Bulletin* No. 221, 20 pp. La Fayette, Ind., 1918.

FATTENING LAMBS IN THE WESTERN STATES; TRIALS CARRIED ON IN 1917-1918. — This Bulletin includes 4 papers aiming at the determination: (1) of the influence of shearing practised some little time before sale of the lambs for slaughter; (2) of the possibility or otherwise of restricting the grain ration to the latter part of the fattening period; (3) of the use of hominy feed " (brewers grain + maize bran) as a substitute for maize. (4) of the value of linseed meal as a protein supplement; and aiming at obtaining also other data regarding soya beans as a protein supplement, the reduction of dry roughage and the increase of silage.

Commencing from October 28, 1917, 7 lots of 25 lambs each and 1 lot of 24 lambs were fed in the trials. The control lot was given maize and cottonseed meal (7 : 1) and, in addition, twice a day, maize silage + clover hay, and was sold with fleece.

The appendedTable indicates the modifications of this diet introduced for the other lots and the more important results obtained. Grain and supplements were mixed in the same proportion for all lots except the lot which was given no grain at the commencement of the feed trials and which was always given cottonseed meal (0,226 lb. per head per day) with silage. During the early days of the trials, all the lambs, except the last abovementioned lot, got a certain amount of oats, altogether about 11 lb. per head, to accustom them to a grain ration.

Under the market conditions at the time of the trials there was no profit. The sale price assigned to the control lot was $17.00 per cwt. The low average gain in live weight realised by the shorn lambs is directly due to the decreased consumption of silage consequent on shearing; the shorn lambs also lost in selling price. Although maize cost $1.12 per bushel and " hominy feed " cost $60.00 per ton, the lambs fed on the latter gave a higher profit because of the smaller consumption of the concentrate per unit of gain in live weight and because of an increase of 10 cents per 100 lb. in the selling price. Feeding with maize limited to part of the period of the trial gave a lower cost of feeding to the extent of about 12 cents per head compared with the control lot, but the lower gain in live weight and the decrease of 15 cents per cwt in the selling price caused a decrease in the profit.

Linseed meal and crushed soya beans were valued at $60.00 per ton and cottonseed meal was bought at $53.00 per ton. The food value of soya beans was equal to that of cottonseed meal; the sale price of the 2 lots which got the former or the latter in an otherwise similar diet, was identical. The difference in the profit is due to the difference in the cost of the food. The increased profit given by the lot which got linseed meal was

(1) For previous work, of which the trials published in *Bulletin* 221 are the continuation, see *R.*, June 1918, No. 669 and *B* May 1919, No. 623. (*Ed.*)

partly caused by smaller consumption of concentrates per unit of gain in live weight. Clover hay was valued at $25.00 and silage at $7.50 per ton, but neither feeding with hay every fifth day only (which reduced consumption by one half), nor completely ceasing to give hay after the 3rd week, that is to say when the lambs received full feed, was profitable because of the smaller gain in live weight.

Results of 90 days trial feeding of lambs.

	Average initial weight	Daily gain per head	Pounds of food consumed per pound gain in live weight				Profit (+) or loss (—) per head
			Grain	Concentrate	Silage	Hay	
	lb.	lb.					$
Control lot	55.9	0.281	2.97	0.52	5.48	2.28	— 0.10
Lot shorn after 75 days	50.2	0.238	3.51	0.62	6.27	2.70	— 1.19
"Hominy feed" instead of Maize.	50.7	0.281	2.93	0.52	5.20	2.27	— 0.23
No grain during first 40 days	56.0	0.278	2.45	0.81	6.34	2.69	+ 0.06
Linseed meal as concentrate	56.3	0.283	2.94	0.52	5.38	2.26	— 0.29
Crushed soya beans as concentrate	56.2	0.280	2.97	0.52	5.52	2.29	+ 0.03
Hay during early weeks only	56.0	0.231	3.01	0.64	8.59	0.87	— 0.40
Hay every 5 days	56.0	0.260	3.21	0.57	7.15	1.24	— 0.10

95 – **Feeding of Lambs: Trials in Kansas, U. S. A.** — *Kansas Agricultural Experiment Station Report, for the Year* 1918, pp. 43-43. Manhattan, 1919.

Comparisons were made between the following nutriments as feeds for lambs in the western United States:— shelled maize and whole kafir corn; alfalfa hay and sweet clover hay; silage and no silage. The trials lasted 60 days, during January and February, 1918. They began with 5 lots of 60 lambs each, but one lot was eliminated later on as it was not proving satisfactory. The annexed table indicates the results from the 4 other lots. The following prices were charged for feeds:— Maize 3 cents and kafir corn 3.5 cents per pound, hay $ 25 and silage $ 8 per ton. It is computed that the value of kafir corn as feed for lambs was only 2.9 cents per lb. while maize in the first lot in the table was worth nearly 3.5 cents.

Results of a 60-day lamb feeding experiment.

Kind of grain and hay fed	Initial weight per head	Average daily gain per head	Food consumed per pound gain			Feed cost per pound of gain	Profit or Loss per lamb	Market grade
			Grain	Hay	Silage			
	Lb.	Lb.	Lb.	Lb.	Lb.	Cents	$	
Maize + alfalfa	61.2	0.44	3.2	4.0	—	14.9	0.40	Prime
Maize + sweet clover	61.2	0.37	3.7	2.7	2.2	15.2	+ 0.02	Choice
Maize + alfalfa	60.4	0.30	3.5	2.4	2.1	14.4	+ 0.23	Do.
Kafir corn + alfalfa	59.9	0.41	3.4	4.2	—	17.0	— 0.50	Good

96 - **Goat Breeding in the Pastures of the West of the United States.** - CHAPLINE, W. R., in *United States Department of Agriculture, Bulletin* No. 749 35 pp., 12 pl., 2 fig. Washington, 1919. GOATS

This Bulletin constitutes a general treatise on goat breeding in pastures. Numerous problems relating to breeding in open grazing grounds are studied chiefly in connection with: — the nature of the pasture; methods of management which will permit of profitable production of goats without detriment to cattle and sheep or to timber reproduction; increase of revenue derived from goats, hair and meat by diminishing the losses caused by death; selection and care of the flocks.

The Bulletin ends with a summary of the more important points regarding management and breeding. The author recommends the division of the grazing ground into 3 parts for use in spring, in summer and autumn, and in winter respectively; the 2nd part should be at the highest elevations, the 3rd in the lowest and most sheltered parts; that portion of the pasture nearest to the sheds should be reserved for use in bad weather.

Over-grazing, which injures the pasture, tree growth, and the yield of the stock, should be avoided; an equal or higher revenue will be obtained by grazing, on the same area, a smaller number of selected goats instead of an excessive number of low grade animals.

The most economical and satisfactory results are obtained with flocks of about 1200 goats; it is best to graze separately goats in milk, dry goats, bucks, yearling and weaned kids. Goats should be put ont to graze for 4 or 5 hours in the cool of the morning and for a similar time in the evening; they should rest during the heat of the day. The bed grounds should be changed several times a year; it would be still better to graze the goats for short distances and to bed them at night where they happened to be in the evening; this allows of the grazing of a larger number and increases the production of goats, hair and meat while improving the pasture. The author recommends the Angora as the breed best suited to the western States of America where goats are kept chiefly for their hair and meat, and secondarily for milk and their skins. Young goats under 18 months of age are not yet suitable for breeding. One buck kept with the does at night and fed with a little grain as a supplementary ration will serve 50 or more does. In 1915 and 1916, for different flocks of Angora goats kept on open grazing grounds in New Mexico, the cost per annum of yearlings was from 95 cents to over $2 a head, exclusive of interest on the capital and the owner's labour; the average annual revenue for 2-year olds was about $2 a head; that for yearlings was slightly higher; the annual cost of pasturage of does and their kids varied from $1.62 to $2.78 per doe, and the average annual revenue per doe from $3 to over $5,50.

97 - **The Goat in Regions Devastated by the War.** — CRÉPIN J., in *Bulletin de la Société Nationale d'Acclimatation*, Year LXVII, No. 9, pp. 265-268, Paris, Sept., 1919.

The author has attempted to show that the general prejudice, in the agricultural world, against goats is very wrong; to show how profitable, from hygienic (very healthy milk consequent on the great resist-

ance of the goat to tuberculosis) and economic standpoints, is rational and well conceived rearing of goats (stall-feeding etc.) and to show what use can be made of the goat in the countries devastated by the war, no domestic animal being able to use, as it can, and to transform into produce, the meagre food which the uncultivated and sterile parts of the fighting zone can offer.

The author recommends for these regions the French Alpine goat for milk and the importation from Asia-Minor of herds of Angora goats to produce, in the north of France, the raw-material for the mohair cloth, already well known by the woollen manufacturers of those regions.

98 – **An Exceptional Case of Milk Secretion in the Goat and its Bearing on the Theories concerning Mammary Development.** — Hill, R. L., in *Journal of Dairy Science*, Vol. II, No. 1, pp. 19-27, 3 fig. Baltimore, 1919.

The author describes the case, noticed at the Maryland Agricultural Station, of a doe kid whose udder was well developed and whose teat yielded, on milking, an abundant flow of milk before she was 4 months old. A photogravure accompanying the article shows the kid sucking her mother while the kid herself is being milked.

This young animal's milk had the normal composition of goat's milk This kid was milked from time to time during about 6 months. The fact that relatively long intervals, even as long as 19 days, between milkings did not stop the secretion of milk proves that the lactation of this young kid differed from a normal lactation consequent on parturition. As this kid had not attained sexual maturity the phenomenon cannot be explained by any theory of mammary development, or of the appearance of milk secretion based on the development of the ovaries, corpus luteum, fœtus or placenta. The mammae of this kid had not been manipulated, had not been sucked and had not been subjected to any treatment to stimulate development or secretion. Possibly some other internal secretory gland may have a preponderant part in regulating the development and the activity of secretion by the mammary glands. Certain facts support the theory that the pituitary gland (*hypophysis cerebri*) might have that function.

PIGS

99 – **Pigs in Southern Albania.** — Massetti, C. in *L'Agricultura coloniale*, Year XII, No. 8, pp. 288-301, 3 figs. Florence, August 31, 1919.

In Albania the breeding of pigs is only of importance to the Christian part of the population, and has therefore spread among the Mirdites and the Malissores of northern Albania, especially in the province of Argirocastre, and in the Lower Greek Epirus.

The present breeds are certainly older than the Ottoman invasion, and very ancient. Two can be distinguished :— the indigenous mountain albanian ; the Epirus " gentile ". The habitat of the first is comprised by the region of Zem, the valley of the Zéta, and the Pindus mountains. They are often kept in herds, in open pasture, in the bush and woods of the mountains. The author thinks that they come from the ancient Illyrian mountain pigs, which have still remained pure. They present all the

characters of the breed which SANSON has named Iberian :— dolichomorphous type; skull dolichocephalous; snout very elongated; small tusks in the male; long legs, short body, not very fat; brown coat, very rarely black; bristles strong and thick, especially along the centre of the back, where they form a veritable mane, but not erectile like that of the wild boar. The male is especially wild, and runs away at the approach of a stranger. These animals are vigorous, robust, large eaters, easy to please; they are not early maturers, nor prolific; the sow generally farrows only once a year. By crossing this breed with other improved breeds very prolific progeny, with delicious flesh, result. A boar of the zootechnical station of Southern Albania weighed, at 9 months of age, 110 kg. The Albanian mountain breed resembles the robust Carpathian and Bavarian pig, from which, however, it differs by its bristles and by its somatic characters.

The Epirus breed is also included in the group of European origin, called by SANSON the " Iberian " breed. It is certainly a pig improved by the Greeks and by the Roumeliotes of Pindus. Its habitat comprises Central and Southern Albania, Western Macedonia, Pindus and Lower Epirus. It is a mesomorphous type, with dolichocephalic skull, pink or white skin, whitish or red pliable bristles, rare except on the dorsal line, where they are thick and bristling for a length of 7 or 8 cm. These animals fatten quickly and easily, they are less robust and less resistant than the preceeding breed; their character is gentle and quiet; they adapt themselves equally well to the damp climate of the plain and to the rigours of the high mountains.

BREEDING. — The young are kept in the sty until they are at least 4 months old; pasturage (acorns and grass) takes place from the end of the winter to the month of August in the low vallies. The animals are often left wthout keepers, and return alone from time to time to the sty; in summer the food given to them consists chiefly of cucurbitaceous plants (gourds, water-melons, melons). In winter they are shut up in the sties, made of branches or of wood, and mud, where they are fed with mashes of maize, sorgum, a little barley, beans and other legumes of inferior quality, cooked roots, cooked potatoes, bran and pollard, kitchen waste, greasy water, whey, all seasoned with salt. Covering usually begins in May or June; parturition in September and October. The sows of the mountain breed bear from 3 to 5 young pigs per litter, those of the Epirus breed 4 to 7. The sow nurses the young from 2 to 2 ½ months. When the number of the young pigs is greater than usual (the author has noticed 11 young ones in one litter) a supplement of goat's milk is distributed after the 15th day. Females predominate in the Epirus breed, and males in the mountain breed. Weaning begins on the 60th day and is finished by the 70th. At 3 months old the boars are selected, and the other young pigs are castrated.

Breeding is generally done with animals of the same kind, but there are Albano-Epirus half-breeds in Southern Albania, Albano-Mongolicza and Albano-Choumadia, half-breeds on the frontiers of Serbia and Montenegro. Besides the pigs already described a very much improved breed com-

monly called "Maltese", which has all the characters of the Apulian breed, has spread especially in Corfu and in the Lower Epirus.

The fattened animal weighs fom 140 to 160 kg. It is slaughtered by cutting the throat, while the half-wild pigs of the mountain breed are shot in the head.

In general, in the Epirus pigs, the lard and fat represent 1/4 of the total weight of the bled animal, against 3/4 for the meat, bones and intestines.

A castrated Epirus pig of 9 months of age, weighing 105.5 kg, gave after slaughter: — head 9.1 kg.; right half 39 kg.; left half 38.85 kg.; heart, lungs, windpipe 1.1 kg.; intestines, stomach, feet 10.2 kg.; bristles 0.547 kg.; blood and waste (by deduction) 6.703 kg. The flesh is smoked, preserved with salt or eaten fresh; in Albania neither small nor large sausages are made, and the ham industry is unknown; the bristles are not used for making brushes; the skins are tanned for the manufacture of saddlery; there are 3 tanneries at Argirocastre. A certain quantity of lard is exported from Albania.

Diseases. The following diseases have been reported: — Swine fever; anthrax; foot and mouth disease; Sarcoptic mange; measles; echinococcus; the 2 last are common in the low marshy zone and cause great damage to the herds there.

100 – **Inheritance Investigations in Swine.** — *Kansas Agricultural Experiment Station Report for the Year* 1918, pp. 41-42. Manhattan, Kansas, 1919.

Cross-breeding experiments with swine gave the following results:

1) The wide forehead (Berkshire) is dominant with respect to the medium forehead (Duroc-Jersey) and to the narrow forehead (Tamworth, wild hog); 2) the straight face (Tamworth, wild hog) is dominant with respect to the dished face (Berkshire); 3) the long face (Tamworth) is completely dominant to the short face (Berkshire); 3) the erect ear (Berkshire) is dominant to the drooping ear (Duroc-Jersey).

101 – **The Feeding Value of Skim Milk for Swine.** — Norton, H. W., Jr., in: I. — *Michigan Agricultural Experiment Station, Quarterly Bulletin* Vol. I, No. 1, pp. 17-18, East Lansing, 1918. — II. *Michigan Agricultural Experiment Station, Special Bulletin* No. 92, 9 pp., 1918.

I. — A summary of the results of a large number of feeding trials by different experiment stations throughout the United States was made to determine the value of skim milk as a supplement to maize and other cereal grains when fed to pigs. It is pointed out that 415 pigs fed on cereal grains only made an average gain of 100 lb. from 486.5 lb. of grain and that 325 pigs fed on cereal grains supplemented by skim milk made an average gain of 100 lb. from 206.9 lb. of grain and 785.1 lb. of skim milk. This indicates that 100 lb. of skim milk replaced 28 lb. of grain. Calculated on the basis of $ 50 to $ 80 per ton for the different grains used, which included maize, wheat, rye and barley, the value of the skim milk ranged from 0.7 to 1.2 cents per pound. Much greater returns were got from the skim milk when 2 to 3 lb. of milk was fed per pound of grain than when the milk was fed in larger quantities.

II. — This bulletin is an amplification of the preceding one. It is computed that a pound of any of the following supplements would replace the designated amount of grain : skim milk 0.28 lb. ; tankage 2.53 lb. middlings 1.05 lb. ; linseed meal 2.62 lb. ; soy-bean meal 2 lbs. Buttermilk is considered to be equal in feeding value to skim milk, and whey about half as efficient.

102 – **A Comparison of Velvet Bean Meal Tankage and Soya Bean Meal as Supplements to Maize Meal in Feeding Hogs.** — Good, E. S., and Mann, L. B., in *Kentucky Agricultural Experiment Station Circular* 20, 4 pp. Lexington, 1918.

A lot of 8 Duroc-Jersey and Berkshire shotes, each weighing originally about 125 lb., was fed on maize meal and velvet bean-and-hull meal (5 : 1), another on maize meal and tankage (9 : 1) and a third on maize meal and soya bean meal (7 : 1) for 89 days. The average daily gains were, respectively, 0.8, 1.52 and 1.42 lb. per pig, and the corresponding amounts of feed consumed per pound of gain were 6.5, 4.2 and 4.5 lb. Although the velvet beans were much cheaper than tankage or soya beans, they were fed at a distinct loss. The velvet bean ration had a wider nutritive ratio than the others, but it was impracticable to increase the proportion of velvet beans since the mixture as it stood was unpalatable, due presumably to the high crude fibre content. It is suggested that a velvet bean meal made from the kernels only would be a more useful feeding stuff to place on the market.

AVICULTURE

103 – **The Choice of Laying Hens.** — Andrew, R. C., in *Utility Poultry Journal*, Vol. IV, No. 9 pp. 2-5, 1 diagr. Harper Adams Agricultural College, Newport, Salop, 1919.

The improvement of poultry stock can be obtained at small cost and with very little trouble by discarding all the defective birds at the right time, so as to keep only the best.

Age at which the choice of hens to keep and those to discard should be made. — In the egg-laying competitions which were held at Harper Adams Agricultural College, Newport, Salop, England, the following data respectively were obtained in the trials of 1915 to 1917 for 252 hens in the 1st year of laying and for an equal number of hens in the 2nd year : — Number of eggs laid in a year by the 252 hens : 43 968 and 28 137 ; average number of eggs per pen of 6 hens : 1046.8 and 670 average number per hen : 177.4 and 112 ; that is to say the hens, in the 2nd year of laying only produced about 60% of the number of eggs laid in the 1et year. In egg laying competitions held in Australia the comparison has been carried up to the 3rd year with the following results :—

White Leghorn breed : — 1st year 209 eggs ; 2nd year 149 ; 3rd year 123 ; Black Orpington breed : — respectively 202, 156 and 118. Except in the case of exceptional merit, hens should, therefore, not be kept after the second year of laying.

Time of the year at which bad laying hens should be discarded. — Summer appears to be better than winter for the selection. The egg production by successive periods of 4 weeks each, dating from the commencement of laying, (13 periods for hens in their 1st year of laying and 12 for those in their 2nd year of laying, determined at Newport, reached its minimum in

the 3rd of these periods, its maximum about the 7th, and decreased rapidly after the 9th, which ended about the middle of June.

The least profitable time for the selection of hens to be discarded is the beginning of spring, for then the cost of keeping the hens during the unproductive winter has been incurred and by not getting rid of them until a little later they would lay eggs which would cover the expense.

The poultry-keeper often makes the time of selection depend on the amount of food produced on the farm and available during different seasons of the year; but, it is never profitable to keep a hen which does not repay the cost of her food. To ascertain whether the eggs laid cover the cost of the food consumed by the flock of hens, the following method may be useful: — Divide the price of 100 lb. of food by the price of one dozen eggs and multiply the quotient by 3; the result gives the number of eggs which should be laid daily by 100 hens to pay for the food. This formula is based on the assumption that each hen consumes 4 ounces of purchased food per day.

When a hen is in laying condition the pubic bones are relaxed, which increases: — (1) The distance between these bones; (2) the distance between the hinder end of the breast bone and these bones. Measurements made at Newport have proved that the distance between the pubic bones is on the average 1.3 inches for hens in laying condition and 8 in. in nonlaying condition, and that the distance between the hinder end of the sternum and the pubic bones for White Leghorns (light breed) and White Wyandottes (heavy breed), respectivelyis: — hens in laying condition 3.1 inches and 3.6 inches; hens not in laying condition 2.1 inches and 3.29 inches. These differences are sufficiently large to be perceptible, the former when measured by the finger tips and the latter by finger widths. It is better to use fingers than an instrument because by so doing it is possible to feel the texture of the skin.

104 – **The Effect of Date of Hatching on Egg Production.** — Buss, W. J., in *Monthly Bulletin of the Ohio Agricultural Experiment Station*, Vol. IV, No. 3, pp. 69-83, 3 figs. Wooster, Ohio, 1919.

Two years' egg production records are presented of three lots of Single Comb White Leghorns, the first hatched on February 22, 1916 and the others 8 and 16 weeks later respectively. At the beginning, each lot consisted of 30 pullets. While laying they had constant access to a dry mash of ground maize, bran and meat scrap (2 : 1 : 2) and were fed on shelled maize and wheat (3 : 1) twice daily to the extent of double the mash consumption. The following table summarises the chief results: —

A table is given which shows the egg production of each lot by 4 week periods during the first year as percentages of the maximum, an egg a day per bird. During August, September and October this percentage in the case of the early hatched lot varied from 26 to 47, but from November 1 to January 24 it was throughout between 6 and 7. During the latter period the pullets went through a moult resembling that of year-old hens. The production of the April-hatched lot varied from 18 to 10 per cent. dur-

ing November, December and January, and showed no pronounced slump until the following November. In all three lots the highest production of any period occurred at the same time, between March 22 and April 18.

Egg record of 3 lots of White Leghorns hatched at different periods in the spring.

Date hatched	Laying record began	Pullet year				Second year			
		Laying period	Average size of flock	No. of eggs per pullet	Feed per dozen eggs	Laying period	Average size of flock	No. of eggs per hen	Feed per dozen eggs
1916	1916	Days			Lb.	Days			Lb.
Feb. 22	Aug. 10	448	29.0	166.9	2.726	364	26.7	109.9	3.098
Apr. 20	Nov. 2	392	28.4	156.4	2.635	364	24.8	119.5	2.993
June 13	Dec. 28	336	29.5	144.0	2.791	364	26.5	118.6	2.658

CONCLUSION. — There is practically nothing to the gained by hatching Leghorn eggs very early (February 22 in the latitude of Wooster, Ohio, U. S. A.), considering the high price which the same eggs would bring on the market, the low fertility, the long period the chicks must be kept in the brooder and the drop in production of the resulting pullets during the winter months.

VARIOUS ANIMALS

105 – **Deer in New-Caledonia; Utilisation of their Flesh by Canning.** — *Bulletin de l'Office colonial*, Year XII, No. 140-141, pp. 533. Paris-Melun. Aug.-Sept., 1919.

Deer have become an apparently irremediable nuisance in New Caledonia. Near St Vincent they are met with in numerous herds, and often in groups of over a hundred. They ravage and destroy everything. It is impossible to keep them out by fencing, because they leap the highest barriers. From Nouméa to Bourail they infest the whole region.

The Pacific Packing Co., wheh has a preserving factory at Neméara, is attempting an experiment which will be welcomed by all, and more particularly by colonists and cattle-breeders. This is the preservation of venison. This company buys deer, unskinned and disemboweled with care, at a price of 25 fr. a head and it organises a rapid transport service to the factory by motor lorry. By this fortunate idea, hunting will become a paying business. Everyone will use it to rid the colony of this harmful game.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

106 – **Team Work.** — RINGELMANN, in *Comptes rendus des séances de l'Académie d'Agriculture*, Vol. V, No. 29, pp. 781-788. Paris Oct. 1, 1919.

In order to study the economic conditions of employing a mechanical cultural apparatus on various typical farms, it is necessary to know

the monthly distribution of the daily work of teams on these farms. But not being able to find this information, which is, after all, in the provinc of rural economy, the author attempted the following preliminary estimat based on some observations, the general applicability of which is contingen on circumstances.

Meteorological returns show, after many years of observation, the aver age number of days of rain, snow, frost, etc., per month, and for variou stations. On snowy days animals do not work in the fields, on frosty day waggons are affected ; but during at least about one third of the days showi as rainy by the meteorologists work on the land is continued.

On the basis of the figures relating to Paris the author thus found 22 days on which teams could work in the fields, with a maximum of 21 day in August, and a minimum of 15 in November and December.

Observations, made on several farms, show that the working hour of teams in the fields may be represented roughly by the time between th rising and setting of the sun, diminished by at least 3 hours. (There ar meals, snacks, the time taken in coming and going from the stables to th fields, etc., but on the other hand the start is often made before sunrise, an the return after the astronomical hour of sunset). Astronomical almanack give the hours of the rising and setting of the sun for every day in the year The calculation may be made on the hours of the 15th day of each month

For the region of Paris 2099 hours of work were calculated to b possible for a team in the fields, with a maximum of 260 hours during th months of June and July and a minimum of 75 hours during December.

The author has given the details of these figures, with a graphic representation, in "*Culture mécanique*" (Vol. VI, p. 152, Librairie agricole de la Maison Rustique, 26, rue Jacob, Paris).

The preceding calculations show that it would be possible to represent teams according to the number of days and hours of work, but it does not follow that the farm would make use of these days and hours.

To do it properly it would be necessary to have during several years, in different farms, suitably chosen, a man whose main duty would be to keep count of the days and hours during which teams were used, as well as the work carried out.

One of the correspondents of the Academy, M. Henry Girard, having become acquainted with these calculations of the author, let him know that he had kept count, day by day of all the work done by his workmen and his farm at Bertrandfosse, at Plailly, the south of the Department of the Oise. He entrusted him with three diaries, consisting of valuable documents, on the subject of which the author gives the following general preliminary information.

The estate of Bertrandfosse included 253.58 ha. in 1911 and 1912 and 271.26 in 1913. The cultivated area (in hectares) has fluctuated in the following manner. — Wheat, 56.3 to 63.0 — Oats, 67.9 to 74 — Beets, 32.7 to 28.0 — Potatoes, 3.7 to 2.7 — Carrots and turnips, 2.5 to 6.5 — Lucern, sainfoin and Black Medick (*Medicago lupulina*) 18.1 to 22.3 — Forage crops, 12. to 11.0 — Meadows for hay 20.1 to 17.8 — Pasture grass, 40.0 to 46.0.

The minimum areas to cultivate, at least once each year, for the following rotations : - wheat, oats, beetrrot, potatoes, carrots and turnips, represent 163 and 174 hectares.

During the years 1911-1912-1913, the total number of draught animals was 17 agricultural horses (2 teams of 4 horses, 3 teams of 3 horses) and 18 strong oxen (3 teams of 6 oxen).

It would be much too long to detail the daily statement, during 3 years, of the day's work of the horses and oxen attached to different work ; however the outhor gives the limits of the number of animals employed each month (average of 3 years.)

Horses. — In January 10 horses at least worked per day, and at most 16 ; in February they varied from 11 to 16 : March, 13 to 17 ; April, 13 to 17 ; May, 12 to 16 ; June, 11 to 16 ; July, 12 to 15 ; August, 12 to 15 ; September, 12 to 16 ; October, 14 to 17 ; November, 12 to 17 ; December, 12 to 17.

The total number of draught horses was fully used only during certain days of the months of March, April, October, November and December. The minimum is shown in January.

Oxen. — In January at least 6 oxen and at most 17, worked per day ; in February, 7 to 17 ; March, 11 to 18 ; April, 13 to 18 ; May, 6 to 16 ; 16 ; June, 2 to 10 ; July, 4 to 12 ; August, 6 to 12 ; September, 8 to 14 ; October, 11 to 17 ; November, 10 to 17 ; December, 4 to 16.

The total number of draught oxen was used only on certain days of the months of March and April ; the minimum is shown in June.

Labour. — On an average for the 3 years, 15 men, 5 women and, as casual labour, 8 Bretons, were employed per day.

Team work. — To sum up the monthly abstracts of the working days, which can be done in graphic form, the author adds together the average working days of horses and oxen for the 3 years, comparing them with the working days which were usable, according to the number of horses, oxen, and working days (that is not counting Sundays and holidays), and giving the monthly coefficients of utilisation. He thus obtained the following Table (see first Table page 102).

Without any agreement with the number of usable working days, the two maxima of utilisation are shown in April and in October, the minima in February and in June.

Of the 10710 working days usable annually, the teams were only used during 7782 working days ; the average annual coefficient of utilisation is 72 % (it varies from 49% in June to 91 % in April); 2928 working days of teams have been unused per year, during which the animals were fed ; this question is important to-day for the heavy draught horses, which cost about 15 fr. a day at Bertrandfosse ; one working day of an unemployed horse constitutes a loss, while the ox, who remains in its stall, takes profit every day from the food distributed to him.

In the second table are brought together the absolute and relative numbers of day's work of teams for the principal work of the heaviest worked months, April and October (average of 3 years).

Month	Number of working days of the teams		Coefficient
	usable	used	of utilisation per 100
January	875	661.0	75.5
February	840	583.9	69.5
March	910	781.4	85.8
April	875	796.5	91.0
May	875	673.7	76.9
June	875	430.9	49.2
July	910	461.9	50.7
August	980	629.0	64.1
September	910	662.7	72.8
October	945	823.7	87.1
November	840	657.2	78.2
December	875	620.5	70.9
Totals	**10 710**	**7 782.5**	*gen. average* **72.6**

Work	April		October	
	Number of working days	Proportion	Number of working days	Proportion
Ploughing	227	28.6	265	32.3
Harrowing, rolling, scarifying	298	37.5	24	2.9
Spreading of manure and sowing	74	9.3	59	7.1
Carting	172	21.6	353	42.9
Various	25	3.0	122	14.8
Totals	**796**	**100.0**	**823**	**100.0**

Thus out of 100 working days of the teams, ploughing only uses 28 and 32, while harrowing, rolling, scarifying and especially carting in October, occupy the greatest number of draught animals.

On many farms, teams are insufficient for ploughing and preparatory work, because they are used for carting which cannot be put off.

This confirms what large farmers near St. Cyr and Brétigny recently explained to the author; they declared that the draught animals, which they are obliged to keep on the farm, would have been fully sufficient for ploughing if they had not been reduced by the number employed on light work and for carting.

The author hopes to continue the inquiry for if what has been stated is confirmed, there would be, in France at least, a new outlook for many mechanical agricultural machines, especially those suited to light work, the drawing of harrows, rollers, seedling-machines and manure spreaders, reapers and binders, and particularly carting on the farm.

Having had the good fortune to have the daily statements of M. HENRY GIRARD'S farm, the author continued to make an abstract of all the work done there, with or without teams. This is certainly a work of rural economy, the results of which — interesting to rural engineering, applicable to farms like Bertrandfosse — cannot be too generalised; but their study would induce other people perhaps to make similar statements, which would be very interesting to analyse (1).

M. PETIT, present at the meeting of the Academy, confirms the observation of M. RINGELMANN on the following points —: (1) April and October are the two months during which teams are insufficient on all farms; (2) The substitution of oxen for horses is to be recommended from an economic standpoint, because resting oxen cost less to feed than horses. But farmers look forward, mainly, to use tractors for the heaviest work, which tires the teams enormously.

107 – **On the Investigation of Resistance to wear of Parts of Agricultural Machines.** — RINGELMANN, M., in *Comptes rendus de l'Académie des Sciences*. Vol. CLXIX, No. 18, pp. 807-809. Paris, Nov. 3, 1919.

Metal parts in the construction of agricultural machinery are subjected to different strains (extension, compression, flexion, torsion), which for the most part are fairly easily calculated. The problem becomes more difficult when we have to consider the incessant action of shocks, developping momentary high forces, which tend to impair or deform the parts.

The author was entrusted by the Society for the Encouragement of National Industry with investigations on the nature of metals employed in the construction of agricultural machinery (tests of hardness and brittleness completed by metallographic tests, thermal treatments and chemical analyses). For many of the working parts, it is specially necessary to consider their resistance to wear by friction in the ground according to the various conditions of work.

A simple process consists of trying each kind of part, made of different metals, working under different loads in the fields; each part is attached to a special waggon, drawn by a team, and provided with an apparatus for registering the distance travelled.

This process is very long, for certain working parts are worn out after a journey of over 2000 km., and it is necessary to make them travel at least 100 to 600 km. in the fields so that a conclusion on each test may be possible. Moreover, for the same parts, it is necessary to carry out comparative trials in various kinds of soil, in different states of humidity and consequently of tenacity.

As these direct trials in the fields are very long, very costly, and consequently inapplicable, the author has got round the difficulty in the following manner :—

(1) Statistical statements on the economy of working the soil, cultivation, and harvesting, have been made already in certain places. Particularly the "Office of Farm Management" of the Department of Agriculture of the United States, has published some in 1916, which concern the western part of the State of New York; for this see *R.*, March 1917, No. 276. (*Ed.*)

The parts are revolved through a given soil, by a large axle, driven at the desired speed by an electric motor; a counter registers the distance traversed, which may be as many kilometres as are desired. In these conditions, for a given kind of working part, after a certain course L, the wear a is noted.

A *standard* of homogenous metal, wearing very rapidly, of the same dimensions as the parts tested, indicates on the testing apparatus a wear A, for a much reduced course l.

To obtain the proportion between the amount of wear of parts in different soils, the standard parts are then made to pass through a course l^1, in the fields, of which the soils are of various kinds, which shows an amount of wear A^1.

It is then easy to compare the amount of wear A^1 and A with a and to deduce from them the journeys L, which each kind of metal can stand in different soils before the part is worn out. With this method, the tests in the fields are made in a single day.

Finally for each kind of working part, shapes, dimensions, and loads, we must work with different metals as physical constants, so as to be able to indicate in each case the course L^1, over which we can in practice use the working parts of machines intended for cultivating the soil.

The same general experimental principle with the use of a suitable standard of rapid wear can be applied to the study of the resistance to wear of different parts used in the construction of agricultural machinery.

108 – **Trial of Three-Furrow Ploughs for Mecanical Ploughing in Italy.** — AMBROSINI, I., in *L'Italia agricola*, year 56, No. 5, pp. 149-150. Piacenza, May 15, 1919.

The majority of trials of mecanical ploughing carried out up to date postulated the use of a constant type of plough, and served to judge the tractor. The author wished, on the contrary, to judge the ploughs which are most generally used, the motive force remaining constant.

The following ploughs were put to the test: — (1) THREE-FURROW PLOUGHS: — (*a*) *with disc coulters*. — Parlin 12", weight 440 kg. — Case 12", 372 kg. — Oliver 12", 464 kg. — Gran Detour 12", 419 kg. — Miliani, 405 kg. (*b*) *ordinary coulters*. Miliani 384 kg. — (2) TWO-FURROW PLOUGHS. Parlin 12", 356 kg.

Trials ware carefully made in two soils, A and B, both of very uniform texture, and the second 25 % lighter than the first. The results are shown in the following table: —

The work done in the two soils with 3-furrow ploughs gave good results but that done with the 2-furrow plough was insufficient.

The 3-furrow Gran Detour plough requires enormous tractive force, which should be partly attibuted to the fact of having taken a ploughing width less than that of the other triple ploughs. The 3 coulters and shares had equal work; the right mouldboard only had its work lightened. But of the active parts of the plough, it is not the mouldboard which meets the greatest resistance. It allows that, when working with a multiple plough, it is not very advantageous to keep within the width of the plough, that

Types of ploughs.	Soil *A*					Soil *B*				
	Depth of ploughing	Breadth of ploughing	Average section of furrow	Average effort	Average effort per sq. dm.	Depth of ploughing	Breadth of ploughing	Average section of furrow	Average effort	Average effort per sq. dm.
	cm.	cm.	sq.dm.	kg.	kg.	cm.	cm.	sq.dm.	kg.	kg.
1) 3-FURROW PLOUGHS										
a) *with disc coulters :* —										
Gran Detour (20 cm)	21 to 22	77 to 81	16.05	1204	75.0	21 to 23	76 to 81	16.97	1132	66.7
Oliver . . . (20 cm)	20 to 22	102to155	21.63	1128	52.1	—	—	—	—	—
Little Genius (20 cm)	21 to 22	93 to 100	20.26	1000	49.3	21 to 23	84 to 93	19.02	683	35.9
Case . . . . (20 cm)	22 to 24	94 to 99	21.15	1198	56.6	21 to 23	85 to 93	19.88	750	37.7
Miliani	24 to 25	87 to 94	22.27	1270	57.0	21 to 23	87 to 96	19.92	806	40.4
b) *with ordinary coulters:*										
Miliani	22 to 23	88 to 96	26.29	1264	62.3	21 to 23	89 to 92	19.56	804	46.0
2) 2-FURROW PLOUGHS										
Parlin. . . . (25 cm)	24 to 27	54 to 62	13.93	1176	84.4	—	—	—	—	—

is to say to take little earth with the right hand share ; it is by making all the shares work fully that the greatest output is obtained ; otherwise one share of the plough should be taken away, reducing it from a triple to a double plough.

The Oliver, Little Genius, and Case ploughs requered almost the same pull, but Little Genius beat all the others. The lightness of traction was constant in this plough which weighed, however, more than all the others, except the Oliver, from which it differs slightly. Moreover it is known that the weight of the 3-furrow plough has very little influence on the traction.

The replacing of ordinary coulters by disc coulters in the Milani plough allows an economy of about 10 % of energy.

The trial with the Parlin 2-furrow plough shows that, when it is wished to work deeper with a plough than the depth for which it was constructed, there is considerable and rapid loss in output (while the Parlin plough is constructed for ploughing to a depth of 20 cm, it was desired to attain with the 2-furrow plough an average of 25 cm). Moreover ploughing with a 2-furrow plough in proportion to the unit of section of the furrow, is always less advantageous than ploughing with a triple plough.

109 – **Mecanical Cotton Ginners in Indo-China.** — See No. 43 of this *Review*.

110 – **Review of Patents.** — *Sources* : — CANADA, *The Canadian Patent Office Record and Register of Copyrights and Trade Marks*, Ottawa. — UNITED STATES, *The Official Gazette of the United States Patent Office*, Washington. — FRANCE, *Office national de la propriété industrielle, Brevets d' invention*, Paris. — BRITISH INDIA, *The Indian and Eastern Engineer*, Calcutta, Bombay, and London. — NEW ZEALAND, *New Zealand Patent Office*,

Journal, published by Authority, Wellington. — UNITED KINGDOM, H. M. Stationery Office, London. — SWITZERLAND, *Patent List* published by the Swiss Bureau of Patents, Berne.

TILLAGE MACHINES, AND IMPLEMENTS. *Canada*: 191784 Combined harrow and cultivator; 191791 Cultivator; 191798 Steam plough combined with manure spreader; 191825 Apparatus for filling up ditches; 192052 Harrow; 192178 Harrow accessory for plough; 192378 Spiral harrow.

United States: 1309831 Garden cultivator; 1309920 Subsoil plough; 1211212 Clod-breaking roller and cultivator combined; 1312669 Cultivator with insecticide distributor; 1313242 Cultivator; 1314292 Accessory for disc harrow.

France: 493624 Improvements in motor'tractor ploughs; 493752 Wheel plough; 493919 Plough with multiple rotating share; 494025 Device for the automatic raising of tools in cultivating machines; 495070 Machine for tilling orchards; 494087 Orchard plough; 494274 Garden plough; 494884 Mecanical traction balance plough; 494959 Steam tractor apparatus for ploughing vineyards; 495268 Arrangement for transmitting electric power to a cultivation set, working on the 2 windlass system; 495329 Machine for earthing-up vjnes; 495330 Root pruning plough (principally for vines); 495341 Improvements to motor ploughs; 496538 Motor earther for cultivation of vine; 496569 Self-acting anchorage system for ploughing with a two-way electric windlass.

New Zealand: 40473 Harrow with scarifying teeth.

United Kingdom.: 128953 Motor cultivator; 130176 Motor plough with multiple turning mould-board; 130437 Raising handle for ploughs, cultivators etc.; 130759 Apparatus for lowering and raising successively the shares of a multiple plough, so as to commence and end uniformly the furrows at the headlands; 131447 Disc harrow, 131715 Disc harrow with back wheels which can be regulated in height; 132550 Cultural apparatus with jointed frame changeable in shape.

MANURES AND MANURE DISTRIBUTORS. *Canada*; 191798 Manure distributor combined with a steam plough:

United States: 1310544 - 1313427 Manure Spreaders; 1313116 Gearing for manure spreader; 1313297 Manure loader; 1313495 — 1313653 Manure distributors.

France.: 496514 Process and plant for preparing dried blood' especially applicable as manure.

India. 4716 Process for making soluble potassic salts by means of felspar.

New Zealand.: 41948 Phosphatic manure (obtained by the calcination of natural phosphates mixed with other ingredients in a rotary kiln).

United Kingdom: 130963. Manure obtained by heating minerals or ground potassic rocks (leucite, volcanic ashes, felspar, granite, etc.) with carbide of calcium, in a current of nitrogen; 131493 Nitrate of lime produced by bacterial oxidation of cyanamide of calcium.

DRILLS AND SEEDING MACHINES. — *United States*: 1311010 Gea-

ring for a maize sower; 1311427 Method of sowing and apparatus relating to it; 1312214 Potato planters; 1312817 Hand sower for maize and leguminous seeds; 132189 Distributing mechanism for potato planter.

New Zealand: 40570 Seeder.

United Kingdom: 128853 Potato planter; 130185-131097 Machines for planting potatoes.

VARIOUS CULTURAL OPERATIONS. — *United States:* 1313310 Machine for destroying weeds; 14715-1313637-1313735 Straw spreaders; 1314122 Machine for rooting out couch-grass; 1314307 Cotton chopper.

France: 495329 Vine earther; 496538 Motor earther for cultivation of vines.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *United States:* 1312969 Distributor of insecticides combined with a cultivator; 1313310 Machine for destroying weeds; 1314122 Machine for exterminating couch-grass.

France: 494077 Soluble insecticidal powder (sulphate of copper 32 kg. + neutral sulphate of soda 36 kg. + carbonate of ammonia 24 kg.); 494351 Improvements to spraying machines; 494959 Devices for sulphating and sulphuring combined with a tractor apparatus for working vineyards.

India: 4856 Process for destroying insects injurious to tea, etc.

United Kingdom: 132214 Insecticidal product destined to destroy the "shot hole borer" (*Xyleborus fornicatus* Eichh), a beetle injurious to tea, coffee, and cocoa plants (mixture of soft soap, resin, and fish oil, which is diluted with water for application by hand, in the form of jelly, to the trees attacked).

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada:* 192188-192243-192328-192388 Reapers; 192408 Hay-rake; 192612 Maize harvester.

United States: 1210133-1212432 Maize harvesters; 1211201 Machine for pulling up and cutting maize stalks; 1311407 Machine for harvesting hemp, 1312010 Machine for picking cotton; 1213880 Rotary hay-rake with lateral discharge.

France: 393749 Apparatus for sharpening scythes; 496311 Device for hand-baler; 496316 Improvements to mowing machines.

New Zealand: 40743 Machine for mowing flax.

United Kingdom: 129118 Mower; 131824 Hay-making machine.

Switzerland: 82556 Sheaf-binder; 82557-82737 Apparatus for gathering fruit; 83073 Apparatus for forging scythes.

MACHINES FOR LIFTING ROOT-CROPS. — *Canada:* 191821 Potato lifter.

United States: 1309617 Beet lifter; 1309940-1310335 Beet harvesters; 1310849 Beet topper; 131305 Machine for harvesting groundnuts; 1314270 Potato digger.

United Kingdom: 131606 Potato lifter.

THRESHING MACHINES. — *Canada:* 192082 Machine for shelling peas; 193135 Thresher for threshing machines.

United States: 1309910 Machine for threshing leguminous seed

plants ; 1310759 Machine for sorting and cleaning grain and seeds ; 1314353 Machines for husking maize.

New Zealand: 40056 Threshing machine.

Switzerland: 82555 Machine for husking maize ; 82.736 Apparatus for separating the seeds of cereals from the seeds of weeds.

Machines and Implements for the Preparation and Storage of Crops. — *Canada*: 192588 Mechanism for compressing silage.

United States: 14704 Machines for cutting potatoes ; 14705 Maize elevator ; 1309861 Machine for gathering and loading hay ; 1310187 1312342 Hay loaders ; 1311451 Machine for making hay-ricks ; 1311742 Apparatus for retting hemp ; 1312066 Machine for transporting litter ; 1312271 Arrangement for keeping ears of maize hung up for seed ; 1312832 Machine for weighing grain.

New Zealand: 40259 Machine for retting flax ; 40412 Machine for retting and scutching flax.

United Kingdom: 131735 Silo.

Switzerland: 83074 Apparatus for cutting vegetables ; 83247 Silo for sweet silage ; 82554 Apparatus for cutting hay heaped up in barns.

Forestry. — *Switzerland*: 73443 Felling and logging machine.

Traction and Steering of Agricultural Machines. — *United States*: 1310604 Tractor.

France ; 494166 Agricultural-viticultural tractor ; 494959 Steam tractor apparatus for vine cultivation ; 495042 Agricultural tractor ; 495268 Arrangement for transmitting electric power to a cultivation set working on the 2 windlass system ; 496121 Industrial and agricultural tractor with 4 driving and steering wheels ; 496522 Tractor for agricultural machines especially for ploughs ; 496569 Self-acting anchorage system for ploughing with two-way electric windlass.

United-Kingdom: 131466 System for coupling agricultural machines to a tractor.

Switzerland: 82553 Propelling device enabling agricultural tractors to get a better purchase on the soil.

Feeding and Housing of Livestock. — *France*: 493807 Safety device for simultaneaously letting out all the cattle from a shippon ; 495328 Improved food for horses, oxen and sheep.

New Zealand: 39726 Arrangement for preventing cattle and horses from jumping.

Poultry Keeping. — *France*: 494086 Temperature regulator for incubators.

United Kingdom: 129838 Granulated food for poultry (prepared with a sticky mash of ground clover, boiled potatoes, and water, which is divided, dried, roasted, and finally impregnated with fish oil).

Bee-keeping. — *France*: 493805 Hive (round, made of rye straw, very low interchangeable blocks, and very light interior frames of variable size ; suitable covers separate the blocks ; the whole is securely fastened with hooks and eyes).

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *United Kingdom*: 132566 Various uses of groundnuts.

DAIRYING. — *New Zealand*: 41475 Milking machine worked by electricity; 41684 Milking machine; 41684 Accessory for milking machine used for taking out samples of milk for weighing them.

United Kingdom: 128544 Artificial milk (obtained by mixing an emulsion of a fat or an oil with skim milk); 128845-130189 Apparatus for sterilising milk; 129105 System of closing churns and other milkreceptacles; 129561 Cheese press.

RURAL ECONOMICS.

111 – **Farm Management Demonstrations in New York State, 1919.**— SCOVILLE G., P., in *Journal of Farm Economics*, Vol. I, No. 2, pp. 44-45. Lancaster Pa., Sept., 1919.

Farm management demonstration work has been carried out in the Niagara county in the Western New York fruit region for the last seven years. The farm bureau committee arranged for a meeting in each of the fourteen school districts in the town. The farmers were asked to bring to the meetings any records they had of their farm expenses and receipts.

At the meeting each farmer attempted to fill out a labour income blank for his farm. Ninety-eight such records were started and generally completed at these meetings; 63 other records were secured through farm calls.

The total number of records taken in Niagara county during the last 6 years was 626.

Since the farm management demonstration work started there have been 4770 labour income records taken in 49 areas in New York State. The tendency is now to reduce the number of areas and to increase the number of records per area. In the northern part of Livingston County, 724 records were taken in the spring of 1919, and the same area was taken ten years ago.

No data have been collected concerning the accounts kept by the farmers; less than 10 per cent. of these farmers, probably, take an annual inventory, but nearly 90 per cent. of them keep some records of their expenses and receipts.

The county agents in New York State have asked for over 4000 inventory books and as many more cash books during the last winter and spring. These books simply furnish a place for taking an inventory and recording receipts and expenses. Farm amounting is of little value without analysing the farm business, therefore in this demonstration work *analysing* rather than recording is insisted on.

112 – **Income Tax and the Farm Management Demonstration Work in Iowa.** — THOMPSON, S. H., in *Journal of Farm Economics*, Vol. I, No. 2, pp. 45-47. Lancaster, Pa., Sept., 1919.

The Income Tax Act has stimulated thousands of farmers in the keeping of farm records. While the Farm Management Demonstrators in Iowa have been consistently urging the need of keeping records in complying with income tax requirements, they have recognised that the income-tax

matter was not an end in itself but merely a method of approach in the study of the farm as a business. Farm officers were deluged with appeals for help ; in too many cases, however, it was not possible to aid the men asking for help in emplying with income tax requirements. Of 76 Iowa farm bureaus that have reported to date, all but three worked with the income tax. The 73 who included the work on income tax and farm records as a project reached 8896 farms.

Forty four bureaus worked only with individuals, while twenty - nine assisted both individual and groups. The bureaus that worked with individuals alone reached on the average 89 each, while those that worked with groups reached one hundred and seventy each More than 60 000 Iowa farmers, on an average of six hundred per county, filed returns this year. Considering the size of the work ahead of the farm bureau the advantage of the group method of work becomes apparent. Meetings held in different parts of the country attended by one hundred farmers would help in solving the problem. These farmers, with the help of the Farm Management Demonstrator, and of the county Agent could be assembled for income - tax instruction and analyses of their farm business. The best time for conducting this work is between December 1 and March 15.

During the present fiscal year Iowa hopes to start a very thorough farm management campaign. As a prelnde it is planned to hold a series of district conferences of country agents where plans for county projects will be fully discussed. It is recognised that varying conditions in the counties will prevent the use of a uniform project. It is contemplated that each county will be given from two to five days of a farm management demonstrator's time for further assistance of the agents through local meetings.

The agent will then personally, or through local demonstrators, extend the work until every township has been given an opportunity to receive instruction on labour income records, cost accounts and income tax.

113 – **Capital Required and Profit to be made on a Farm in West Africa.** — Dumont, P., in *La Vie agricole et rurale* (from a paper by M. Fallon on Agriculture in the Belgian Congo), Year IX, No. 9, pp. 159-162. Paris, 1st March 1, 1919.

Owing to the rush to colonial agriculture, which will doubtless be made after peace is signed, the author extracts from a paper by M. Fallon (published by the Minister for the Belgian Colonies) some advice which may serve as a guide to intending colonists of West Africa.

Two questions interest them specially : —

(1) What capital is required for starting a paying farm ?

(2) What profit may be expected from rational cultivation ?

I. Initial capital required for equipping a farm in West Africa.

The capital required for the equipment of a farm obviously varies according to the conditions of the locality in which it is situated. The following figures are average ones and are only given as an example : —

(A) *Market garden farm of 20 hectares on the outskirts of Elizabethville.*

	Fr.
25 labourers for 6 months at 18 fr. per month	2 700
Tools: shovels, spades, wheelbarrows, rakes, hoes, watering cans	500
2000 kg of potatoes at 0. 80 fr. ker kg.	1 600
Purchase of garden seeds, maize, groundnuts, sorghum and beans	200
200 fruit trees at 3. 50 fr. each	700
50 chickens at 10 fr. each	500
20 rabbits at 6 fr. each	120
25 goats, at 25 fr. each	625
Poultry food: 6 sacks of sorghum at 30 fr. each	180
Colonists' food for 6 months	1 200
Unforeseen expenses, such as loss of animals, purchase of various things	500
Total Fr.	**8 825**

The cost of housing and the rent of the land are ecluded.

(B) *Large farms worked with draught animals.* Examples of farms of 100-200-500. ha worked in the Katanga district free from tsetse fly.

	100 ha.	200 ha.	500 ha.
Agricultural stores	4 000 fr.	7 000 fr.	14 000 fr.
Tools	1 000 »	1 200 »	2 000 »
Carts	1 000 »	1 000 »	2 000 »
Miscellaneous	3 000 »	4 000 »	7 000 »
Labourers for 1 year	50 = 9 000 »	100 = 16 200 »	200 = 38 400 »
Oxen at 300 fr. each	50 = 15 000 »	70 = 21 000 »	150 = 45 000 »
Harness	500 »	700 »	1 500 »
Food of colonist for 1 year	2 100 »	2 400 »	2 400 »
Temporary housing, stables.	3 000 »	4 000 »	5 000 »
Unforeseen expenses	4 000 »	5 000 »	5 000 »
Total Expenses	**43 500** fr.	**65 500** fr.	**122 300** fr.
Expenses per ha. for the 1st. year	435 fr.	328 fr.	245 fr.

MECHANICAL CULTURE. — Working a farm with machinery is not really economical unless it is extensive. A steam tractor is not advisable on farms of less than 400 ha., though a small tractor might be useful on a farm of 100 ha.

The profit in cultivating at Katanga lies in the high prices fetched on the market by all agricultural produce.

SALE PRICE AND RENT OF AGRICULTURAL LAND.

1st *Class.* — Land situated on the outer boundaries of towns, inhabited centres or on strips of 150 m. along the railways or navigable rivers: — sale price, at least 5 fr. per ha.; rent, 5 % of the sale price.

2nd *Class.* — Land situated at least 5 km. outside the previously mentioned limits: — sale price, at least 3 fr per ha.; rent 5 % of the sale price.

3rd *Class.* — Land situated at least 15 km. outside the previously mentioned limits: — sale price at least 1 fr. per ha.; rent 5 % of the sale price.

Cost of different kinds of houses. — The cost is obviously very variable according to the size of the building and also according to the materials used in its construction. If one is contented with local materials and rammed earth to commence with, the cost for a single roomed house would be 500 to 1000 fr. and for a double roomed house 1200 to 1300 fr. A brick house, 2 rooms, costs 4000 to 6000 fr. and with 3 rooms 10 000 to 15 000 fr.

An iron house with a floor area of 31 square m. and 2 rooms costs 3000 to 5000 fr. With 3 rooms and a floor area of 115 square m., the cost would be 9000 to 12 000 fr.

Wages of native labour. — The supply generally exceeds the demand and the tendency of wages to rise is due to dearer living. Agricultural labourers get 10 to 20 fr. a month, more usually 12 to 15 fr. Carriers receive 0.50 fr. a day and take loads of 30 and 35 kg. without difficulty.

In bush country, clearing takes, on the average, 100 days work and costs 40-70 fr. per ha. In forest clearing, felling, stumping, chopping and burning wood may be taken at an average of 300 days work per ha. and the cost at 140 to 180 fr. To that sum must be added 30 to 50 fr. for getting the land in order, filling up depressions, levelling and extracting roots.

II. — Profits to be made by colonial cultivation. These profits are obviously very variable according to the kind of crop and the year. As an example the results obtained are here given : — (1) for a rubber plantation ; (2) for a coffee plantation ; (3) for maize.

(1) Hevea plantation at Yangambi (Stanleyville) (high forest country).

(A) Creation of the plantation.

	Fr. per ha
Clearing, getting the land in order: 900 days at 0.65 fr. (1)	585
Levelling, holing: 330 days at 0.65 fr.	195
Nurseries: 20 days at 0.65 fr.	13
Transplanting: 40 days at 0.65 fr.	26
Total	**819**

(B) Maintenance of the plantation.

Weeding: 45 days at 0.65 fr.	29.25
Taking away broken and diseased trees, replacing them: 12 days at 0.65 fr.	7.80
Treatment of diseased trees: 18 days at 0.65 fr.	11.70
Green manuring: 26 days at 0.65 fr.	16.90
Upkeep of roads: 5 days at 0.65 fr.	3.25
Total	**68.80**

Yield : — 200 to 300 kg. of dry rubber per ha. worth 5 to 6 fr. per kg.

(1) The high cost of clearing is due to the fact that, for Hevea, it is necessary to stump completely the land to be planted. (*Author's note*).

(2) Coffee plantation at Lula (Stanleyville).

(A) Creation of the plantation.

	Fr.
Creation and upkeep of nurseries: 404 days at 0,52 fr. (1).	210.08
Clearing and getting the land in order: 5090 days at 0,52 fr.	2 646.80
Filling in, levelling, digging, extracting roots: 1 478 days at 0,52 fr. .	768.56
Staking, making and filling in holes: 1 220 days at 0,52 fr.	637.40
Planting and shading: 235 days at 0,52 fr.	122.20
Green manuring and draining: 355 days at 0,52 fr.	184.60
Total Expenses . . .	**4 566.64**

Expenses per ha.: — 304.45fr. for an average yield of 1 000 kg worth 1 350 fr.

(B) Maintenance of the plantation (Account for a plantation of 106 ha.).

	Fr.
Weeding, cutting green manure, upkeep of roads and drainage: 5 667 days at 0,65 fr.	2 946.84
Pruning coffee bushes, shade trees and terraces of *Leucaena glauca*: 1 007 days at 0,52 fr.	523.64
Diseases and pests of coffee bushes: 326 days at 0,52 fr.	169.52
Total Expenses . . .	**3 640.00**

Expenses per ha.: 35 fr.

(C) Picking and preparation of coffee berries.

	Fr.
Picking 315 251 kg. of berries.	2 613.91
Sorting	1 806.79
Pulping, fermenting, washing, drying, husking and manipulating the coffee, water supply for machinery, wood cutting	2 343.50
Total Expenses . . .	**6 764.20**

The yield for 1916 being 60 000 kg. of prepared coffee, the cost of picking and preparation is about 0,11 fr. per kg. of coffee.

(3) Maize cultivation at Katanga.

(A) Preliminary work effected by steam engines.

The use of steam ploughs cost daily: —

	Fr.
2 mechanics.	50
Oil for cylinders, 15 litres Oil for joints, 17 litres	56
8 labourers	12
Amortisation	63.33
Total Expenses . . .	**181.33**

(1) This includes all expenses except the salaries of the European staff. (*Author's note*).

In virgin soil 1.5 ha per day is ploughed. In land previously cultivated, free from ant hills and marsh as much as 4 ha. a day may be ploughed. 4 ha. can be harrowed per day.

Ploughing and harrowing 1 ha. in virgin soil costs 165.40 fr.; ploughing and harrowing 1 ha. in cultivated land costs 80.75 fr.

(B) Preliminary work effected by draught animals.

6 oxen at 250 fr. After 3 months the animals are sold at half price, say a loss of 750 fr.

	Fr.
1 driver at 100 fr. a month. / 2 labourers at 30 fr. a month. \	160

Area ploughed in a week : — 2 ha.
Area harrowed in a week : — 3 ha.

In 1 month 9 ha; which makes $\frac{750}{3} + 160 = 410$ fr. Say 29.28 fr. per ha. Total : — 45.50 fr. + 29.28 fr. = 74.78 fr.

This figure should be increased by the amortisation of plant estimated at 800 fr.; period 4 years ; annual working season 6 months ; this makes 12.50 fr. per month and 0 fr. 54 per ha.

One ha. ploughed and harrowed with oxen costs 75.32 fr. We have just seen that 1 ha. worked by mechanical means costs 165.40 fr. or 80 75 fr. according to the state of the soil.

Supplementary expenses for the cultivation of maize.

	Fr. per ha
Seed	7.50
Sowing, weeding, earthing up, harvesting	66.00
Sacks for 1.500 kg. at 1.60 fr. each	24.00
Amortisation	2.00
Renting value of land cleared and ploughed by the Agricultural Department at 300 fr. per ha. at 5 %	15.00
(If the colonist does the clearing at his own expense this amount is certainly not exaggerated).	
Cost of carring the crop for a farmer near a town at 10 fr. a ton (crop of 1 500 kg. per ha.)	15.00
Total Expenses	**129.50**

Recapitulation. — One ha. of maize, ploughed and harrowed with mechanical means, will cost 210.25 fr. without taking into account the transport of the material (in virgin soil 294.90 fr.); 1 ha. of maize ploughed and harrowed with oxen will cost 204.82 fr..

Maize sells on the spot, at Katanga, at 250 to 300 fr. per ton.

It can be seen from these few examples what profit can be made from a colonial farm cultivated rationally.

114 – **Correlations in the Cost of Milk Production, in the United States.** — Hopkins, J. A., junior, in *Dairy Science*, Vol. II, No. 2, pp. 63-98, and No. 3, pp. 208-255. Baltimore, March and May, 1919.

An attempt to discover some of the correlations existing among the different economic factors in the dairy industry and especially to bring to light the effects of these factors on the production and cost of production of milk. It is based on statistics established and used for the

investigation of the relations between the size of a dairy and economy in milk production (1).

All data are for the year 1916 ; the interest on capital is calculated at 5 % ; depreciation and insurance are estimated at 20 % for cows and at 12 % for bulls ; manure is assigned an arbitrary value of 1 dollar per ton.

CORRELATIONS BETWEEN LABOUR AND OTHER FACTORS IN MILK PRODUCTION. — The 87 dairies of Delaware and Pennsylvania concerned in the statistics were divided, for the purpose of the investigation, into 16 classes, not only according to the number of cows per dairy but also according to the number of hours of labour employed in them during the year and according to the importance of the product which they sold, namely :—

(*A*) Dairies producing market milk : — (*a*) employing annually less than 140 hours of labour per cow : — (1) dairies with less than 20 cows ; (2) with 20 to 39 cows ; (3) with 40 cows or more ; (*b*) employing annually from 140 to 200 hours of labour per cow : — (4) with less than 20 cows (5) with 20 to 39 cows ; (6) with 40 cows or more ; (*c*) employing annually more than 200 hours of labour per cow ; (7) with less than 20 cows ; (8) with 20 to 39 cows ; (9) with 40 cows or more.

(*B*) Dairies producing butter (all except 2 with less than 20 cows) : — (10) employing annually less than 140 hours of labour per cow ; (11) from 140 to 200 hours ; (12) more than 200 hours.

(*C*) Dairies producing milk of superior quality and milk for children (all with more than 20 cows) :— (13) employing annually less than 140 hours of labour per cow ; (14) from 140 to 200 hours ; (15) more than 200 hours.

(*D*) Dairies producing " certified milk " of guaranteed purity ; all with 80 cows or more and employing annually more than 200 hours of labour per cow.

For this investigation and for these which followed, statistical abstracts for each class are given in tabular statements, are represented in diagrams and are discussed ; a summary is given of the conclusions established

It cannot be said that the labour used in the dairies where less than 140 hours of labour per cow was employed annually was positively insufficient, for in several cases, with good organisation, satisfactory results were obtained even with much less labour. It should not be forgotten that the following conclusions only apply to the averages of the dairies included in this study.

(1) Up to an average of 168 hours of labour per year per cow, the revenue of the dairy increased with an increased number of hours of labour ; in other words, up to that limit, each unit of labour applied gave an increase in production higher than that given by the preceeding unit.

(2) After the above-mentioned average, the advantage decreased.

(3) Dairies in which from 140 to 200 hours of labour per year per cow was employed have a larger capital per cow in buildings and equipment compared with dairies in which less than 140 hours or more than 200 hours of labour is employed.

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(1) See *R.*, April, 1919, No. 513. (*Ed.*)

(4) Dairies employing the most labour pay a higher price for it.

(5) On an average, the cost of milk production per quart is lower in dairies employing annually from 140 to 200 hours of labour per cow than in those employing either more or less.

(6) Dairies employing larger amounts of labour per cow had more vigorous calves dropped and a greater production of manure.

(7) Where more labour was employed, the other expenses increased in proportion, but not so rapidly, as that of labour.

CORRELATIONS BETWEEN THE AMOUNT OF CONCENTRATES GIVEN AND OTHER FACTORS. — The 87 dairies in which these investigations were made were divided, for the purposes of this inquiry, into 3 groups according as each cow was given annually :— (*A*) less than 2000 lbs of concentrates ; (*B*) from 2000 to 2999 lb ; (*C*) 3000 lbs or more.

Each of these groups was subdivided into 3 according as the dairy contained :— Fewer than 20 cows ; 20 to 39 cows ; 40 or more.

The results are summarised as follows :—

The value of the cows rose with the increase in the consumption of concentrates. This was partly due to the better condition of the cows resulting from more intensive feeding and partly to a difference in their productive capacity.

(2) With the increase in the quantity of grain per cow there was also a slight increase in the quantity of silage consumed.

(3) The quantity of forage consumed decreased as the consumption of concentrates increased.

In the smaller dairies this was partly due to more intelligent use of roughage in those using a larger quantity of concentrates.

(4) Slightly more labour was employed in dairies in which large quantities of grain were given.

(5) The production per cow increased as more concentrates were consumed, but :

(6) There is an inverse correlation between the quantity of concentrates fed and the production of milk per unit of weight of grain. Large dairies can produce more milk per unit of weight of grain than the small dairies when only a small quantity of grain is used, but, when a larger quantity is used, this advantage is lost.

(7) The cost of milk per unit of volume tends to increase slightly with an increase in the consumption of concentrates.

CORRELATIONS BETWEEN THE PROPORTION OF CONCENTRATES PURCHASED AND THE COST OF MILK PRODUCTION. — The dairies for which statistics were collected were divided into 3 groups according as the percentage of concentrates purchased relatively to the total concentrates fed was :— less than 50 ; from 50 to 79 ; from 80 to 100 ; each of these groups was subdivided into 3 classes according as the dairy contained :— fewer than 20 cows ; 20 to 39 cows ; 40 cows or more.

The results were as follows :—

(1) It was noticed that the greater the incentive to saving and economy in expenditure, the smaller the proportion of concentrates purchased.

Thus the tenant farmers, who may be assumed to have a greater incentive to save, purchased a smaller proportion of concentrates than the owners. Similarly, the owners of small dairies, whose economic conditions may be assumed to be inferior to those of the owners of large dairies, mostly belong to the groups buying less than 80 % of the grain consumed. The middle group of dairies are found for the most part in the group buying the most grain.

(2) In the classes purchasing from 50 to 79 % of the grain used, a much larger amount of food, both forage and grain, was fed than in the classes which bought less than 50 %. This may be attributed, as noted above, to a greater liberality in expenditure on the part of the farmers. But the dairies which purchased the largest proportion of grain, use less food than any of the other classes. This may be attributed to the better quality of the food used and to the more efficient use made of it.

(3) The middle group of dairies employ the smallest amount of labour.

(4) Production, cost, and profit or loss per unit of volume of milk are influenced by the 3 factors noted above. But the reciprocal effects among these factors and others are such as to make it impossible to state that production, cost, and profit or loss per unit of volume of milk are influenced by the proportion of food purchased relatively to that grown on the farm.

CORRELATIONS BETWEEN THE AMOUNT OF FORAGE FED AND THE OTHER FACTORS IN MILK PRODUCTION. — The dairies included in the statistics were divided for the purposes of this enquiry into 3 groups according as each cow received annually less than :— 1.5 tons of forage; from 1.5 to 1.9 tons ; 2 tons or more ; each of these groups was subdivided into 3 classes, as in the previous cases, according to the number of cows per dairy.

Many small dairies use large amounts per cow of cheap roughage of low nutritive value while the larger dairies use forage of better quality. This makes a comparison between amounts of forage alone erroneous, but the following conclusions may be taken as sufficiently safe :—

(1) In dairies which make an efficient use of forage there is a tendency for the value of the cows to be higher.

(2) Generally more grain is used in dairies where a greater amount of forage is used.

(3) An increase in the amount of forage is generally accompanied by an increase in the amount of labour.

(4) The yield per cow tends to increase, but not proportionally, with an increase in the amount of forage fed, and at the same time, up to a certain point, the cost of production per unit of volume of milk probably decreases and the profit per unit of volume increases if the increase in the amount of forage is not accompanied by a corresponding or greater increase in one of the other factors of expenditure.

CORRELATIONS BETWEEN SILAGE AND OTHER FACTORS. — For this enquiry the dairies were divided into 3 groups according : — as they consumed no silage ; as they consumed less than 6 tons per cow annually ; as they

consumed 6 tons or more ; each of these groups was subdivided into 3 classes as in previous cases. The following facts were noted :—

(1) Silage is not generally used in small dairies or on tenant. farms.

(2) A greater amount of silage is used in dairies containing cows of high value.

(3) The use of silage instead of pasturage increases the cost of milk production.

(4) The total amount of forage at first is reduced, then increased as at first little, then much, silage is fed.

(5) Increase in the amount of silage fed is accompanied by an increase in the amount of grain consumed and in the amount of labour

(6) Production is increased by the use of silage, but the cost of production per unit of volume of milk is also increased, partly or wholly, by the effect of using more grain and labour and less pasturage.

Correlations between the value of the cows and other factors. — The dairies were divided into 3 groups according as the average value per cow was under $75, $75 to $90, or over $90 ; each of these groups was subdivided into 3 classes according to the number of cows, as in previous cases. It was noted that :—

(1) The value attributed to the cows by their owners and at which they found buyers, supplies a sufficiently accurate index of their productive capacity if a large number of dairies are considered. In individual cases an accurate appraisal was not always obtained, but variations from the normal tend generally to neutralise each other.

(2) Investment in buildings and equipment showed no correlation to the value of the cows.

(3) The more valuable cows receive more silage and are pastured less than less valuable cows.

(4) These is a general tendency to feed less forage and a well defined tendency to feed more grain to the more valuable cows, which shows the capacity of the more valuable cows to consume greater quantities of food, especially grain.

(5) More labour is devoted to the more valuable cows.

(6) The cost of production per unit of volume of milk showed conflicting variations, which proves that other factors besides the natural productivity of the cow influence the cost.

(7) Except in the case of dairies producing milk of superior quality, the owners of the more valuable cows accept lower prices for their products than those obtained by owners of cows of medium value.

(8) The less satisfactory marketing methods of owners of more valuable cows were more than compensated by the greater productivity of those cows, with the result that the profit per unit of volume of milk was higher.

Correlations between tenantry and other factors. — The principal difference between dairies worked by their owners and those worked by tenants lies in the tendency to greater saving and in less liberality in expenditure on the part of tenants.

The owner has also a tendency to spend less on dairies which he lets out, so that the cows often suffer from the excessive thrift of the owner and of the tenant.

Production, its cost, and profit per unit of volume of milk are generally in favour of dairies operated by their owner but the differences are slight and inindividual cases may be nil.

Production. — For this enquiry the dairies were divided into 3 groups according as the annual production per cow was less than 2 200 quarts, from 2 200 to 2 800 quarts, or more than 2 800 quarts ; each of these groups was subdivided into 3 classes according to the number of cows per dairy in the usual manner. It was noted as follows :—

(1) The general increase in production from one group to another was accompanied and caused by a simultaneous and proportional increase in the use of each of the principal factors of production.

(2) While an increase in the use of any one isolated factor may give rise to a very slight increase in production, if all the factors increase simultaneously and proportionally the production may respond proportionally.

(3) An increase in production does not necessarily imply a greater cost for each new increment, and it may even be accompanied by a decrease in the cost.

Cost of production. — For this enquiry the dairies were divided into 3 groups according as the net cost of milk was less than $0.050 per quart, from $0.050 to $0.064 per quart, or $0.065 or more per quart; each of these groups was subdivided into 3 classes according to the number of cows per dairy in the usual manner. The results are summarised as follows : —

The " cost of production per unit of volume ", like " production ", is not a simple factor like the factors " amount of labour ", " silage ", " grain " etc., but is a complex of all the factors in the cost of production. If a product of uniform grade and quality is considered, the cost of production per unit of volume is the most satisfactory measure of efficiency of production. Since the best system of management and feeding differs according to various conditions, it is to be expected that only those factors which vary slightly in different systems of management of cows should show well defined correlations with the cost of production per quart of milk and that the other factors should be more or less distorted by contrary factors. It may, however, be said that : —

(1) The cost of production per quart of milk is lower in dairies composed of valuable and highly productive cows than is those composed of cheap and poorly productive cows.

(2) The replacing of pasturage by silage is accompanied by an increase in the cost of production.

(3) The dairies which produce the cheapest milk are enabled, by good management, to use less labour than dairies which produce milk at a higher cost.

(4) Factors which lessen the cost of production by efficiency of system and management also give a higher production.

(5) Dairies which suffer the heaviest losses on their products succeed in partially reducing this loss by finding buyers who pay the highest prices for the products in question. But this increase in price is insufficient to eliminate the increase in the cost of production and those which produce milk at the highest cost suffer the heaviest losses per quart.

Conclusions. — (1) Units of labour are most productive about the upper limit of the medium class for the amount of labour employed.

(2) There is an inverse correlation between the quantity of grain consumed per cow and the production per unit of grain.

(3) The proportion of food bought does not necessarily influence the cost of production.

(4) When forage is used efficiently, production may be increased and its cost decreased by using large amounts of forage of good quality.

(5) The use of large amounts of silage increases production, but is accompanied by an increased cost of production per unit of volume of milk, caused more or less by the simultaneous increase in the use of grain and labour and by the substitution of silage for pasturage.

(6) The price at which cows are sold provides a sufficiently satisfactory measure of their productive capacity.

(7) Tenantry has not much effect on the dairy business, except the tendency to give the cows too little care and to spend too little to bring them to the point of maximum efficiency.

(8) An increase in production does not necessarily imply a greater cost per unit of product, and an increase obtained by a proportional increase in the use of all factors may also have the results of reducing the cost.

(9) Low cost of production which accompanies increased profit depends chiefly on the ability of the dairyman to use the different factors of production in the most favourable proportions in the particular circumstances in which he is situated.

115 – **The Cost of Milk Production Computed on the Year Basis.** — Pearson, F. A., in *Illinois Agricultural Experiment Station Bulletin* 216, pp. 343-364. Urbana, Ill., 1919.

These studies were undertaken to derive workable formulae that would express the cost of producing fluid milk (for the Chicago market) in terms of amounts of feed and labour used, and not of the monetary value of the expenses incurred.

A study of the herd cost is based upon the records during the fiscal years 1914-15 and 1915-16 of 36 farms on which there were 873 milch cows, 225 calves (and heifers not in milk) and 35 bulls, and where 6511 lb. of milk and 235 lb. of butter fat were sold per cow during the period. Production in the 6 winter months was 56 % of the yearly total. The gross cost of producing 100 lbs. of milk was found to average $2.25, the percentage of the several items being: Feed other than pasture 60.7; pasture 5.3; man labour 17; horse labour 3.4; interest on herd 4.9; building charges 3.6; equipment 1.3, and miscellaneous 3.8. A managerial charge

was not included. The cost other than for feed (excluding pasture) and man labour totalled 50.16 cents, which almost exactly balanced the 49.69 cents credit from appreciation of stock, manure, hides, beef and other miscellaneous returns. The production cost on these farms can thus be expressed in terms of feed and labour. The amounts per 100 lb. of milk were approximately 44 lb. of grain; 188 lbs. of silage and other succulent feed; 50 lb. of hay; 39 lb. of other roughage and bedding; 2.42 hours of man labour. This is the formula for "year cost".

To correct for seasonal variations in cost of production it is suggested that the price of any month be that percentage of the year cost which represents the average variation of that month from the average year price during the period 1907-1916. A table showing these monthly percentages is given. It is noted that only 61.8 % of the grain fed was purchased, whereas in farms providing milk for New York City the purchased grain was about 98 % of the total (A. L. THOMPSON, Cost of Producing Milk on 184 Farms in Delaware County, New York, in the *New York Cornell Station Bulletin* 364, pp. 109-179. 1915).

In 16 of the above farms, embracing 428 cows, the records permitted the separation of the cost of rearing young stock from the herd cost, the difference being the "cow cost". The net cost of producing 100 lb. of milk on this basis was $ 1.70, which is 215.6 % of the cost of feed (excluding pasture) and man labour. The amounts of feed and labour were approximately: Grain 35 lb.; silage 140 lb.; hay 36 lb.; other roughage 29 lb., and man labour 2.36 hours. To find the year cost on this basis it is necessary to increase the total of these items by 25.6 %. Corrections for seasonal variation may be made as before.

A short discussion of some data from 680 dairy farms in Kane and Mc Henry Counties in Illinois is given, mainly to show that the "farm cost", obtained by deducting from the total farm expenses the receipts derived from all sources except the dairy, is a misleading measure of milk production costs.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON VEGETAL PRODUCTS

116 – **Information Regarding the Choice of Apples intended for Making Cider.** — See No. 59 of this *Review*.

117 – **Oil Content of Linseed grown in the United Kingdom in Relation to Origin.** — See No. 48 of this *Review*.

118 – **The Copra Industry of the West Indies.** — MEYERS, L. M. B., in *Weekly Bulletin, Department of Trade and Commerce, Canada, Commercial Intelligence Branch*, Vol. XXI No. 814, pp. 478-481. Ottawa, Sept. 8, 1919.

The copra industry in the West Indies might be said to be in its initial stage, except perhaps in Jamaica, Trinidad, and British Guiana, but even in those colonies it is capable of far greater development than it has hitherto attained.

During the war there was a great demand for copra, owing to the shortage and increased demand for animal and vegetable fats, which gave the industry a new impetus. Greater attention has therefore been given to it in most of the coconut-growing islands and the colony of British Guiana, and it is generally considered that the future of the industry bids fair to be promising.

In his annual report on the trade of Jamaica for 1917-18, the Acting Colonial Secretary stated that the copra industry was extended during the year and that drying plants are being erected in ever increasing numbers in coconut districts. Allowing for nuts converted into copra, the exports of coconuts amounted to 30 000 000 nuts, and but for the hurricane, a remarkable progress of the industry would have been established. Large numbers of young trees, he states, were then coming into bearing, and with average good fortune, the exports of the industry should show a progressive increase for the next ten years.

Special mention of the industry was also made by the Colonial Secretary of Trinidad and Tobago in his annual report on the trade of those colonies for 1917. He states that the cocoanut industry has now quite recovered from the droughts which affected it in former years, and though the number of nuts exported in 1917 was 1 253 925 less than in 1916, this was more than compensated for by an increase in the exports of copra, which rose from 3 339 848 lb. in 1916 to 7 201 448 lb. in 1917 which, he states, is equal to about 18 000 000 nuts.

In the annual report on the trade of British Guiana for 1918, the Comptroller of Customs also made special mention of the coconut industry as one of the sources of increased revenue of the colony, and stated that, owing to the increased demand for coconut oil and copra, there was a large increase in the output, the increase in the latter being 109 798 lb. Two-thirds of the total yield of copra for 1918 was exported to the United States, while one-third went to the United Kingdom. The total output of coconut oil in British Guiana in 1916 was 17 948 gallons and the value $16 523, while in 1917 the total output was 26 674 gallons and the value $28 652.

It is estimated that Trinidad produced annually about 140 000 gallons of oil for the consumption of the local population. The export is small. The amount of oil produced depends in great measure on the relative price of copra. When the export price of copra offers more profit than its manufacture into oil, the owners naturally prefer to sell copra.

In addition to the export of copra in recent years, there is a very large export of coconuts from the various colonies which gives a correspondingly large margin for the further production of copra, should there be an increase in the demand and in price.

The following comparisons showing the rise in price of copra in 1916-18 may be of interest. In 1916 the total output of copra in British Guiana was 237 104 lb. and the value $10 012, while in 1917 the total output was 168 764 lb. and the value $12 164. The total yield for the year 1918 was 278 532 lb. and this realized the sum of $20 801. These figures show that the price of copra almost doubled in 1918 as compared with 1916.

With respect to the relative oil content of copra, while there no information to hand in regard to the various grades, yet it is of interest to know that in a recent report by Professor HARRISON, the Director of the Department of Science and Agriculture of British Guiana, who is also the Government analyst, it was stated that the general average content of oil was 2-5 gallons to every 100 ripe nuts, which can be taken as a fair and correct general average for commercial purposes. It is generally considered that coconuts give their best yield of copra during the dry season of the year, which differs in each island almost.

Copra exported from the British West Indies during the years 1914—1917.

		1914	1915	1916	1917	1918
Jamaica	lb.	183 530	1 223 817	1 162 331	2 653 517	—
Trinidad	»	2 358 154	3 986 731	3 330 848	7 021 448	—
British Guiana	cwt.	1 601	1 619	2 117	1 407	2487
Windward Islands	»	330	148	450	312	—
Leeward Islands	lb.	—	—	3 301	—	—

119 – **Crêping African Rubber.** — VON PELT, G., in *Institut Colonial de Marseille, Bulletin des Caoutchoucs*, No. 2, pp. 53-78. Paris-Marseilles, 1919.

The Colonial Institute of Marseilles having commissioned the author (Head of the rubber branch at that Institute) to study the conditions under which African rubbers could be improved, these rubbers being out of demand compared with plantation rubber, he has made the present preliminary study before leaving for West Africa to make a complete study of the matter on the spot. The reasons given by manufacturers to explain their preference for plantation rubber, a preference which during the last few months has been pushed to the point of refusing to buy African rubber, are: — (1) The necessity of crêping African rubbers; (2) the loss which that operation causes by washing; (3) the tendency of these rubbers to become sticky.

The author compares the manipulation of plantation rubber with that applied to African rubbers with the object of noting in what respects the preparation of the collected rubbers should be modified so as to give them, as far as possible, the qualities of plantation rubber.

He examines successively: — (1) plantation rubber: tapping, collection, straining, coagulation, preparation, drying, smoking, packing — (2) collected rubbers, not undergoing any of these treatments and consequently being of much inferior quality at the time of purchase. Crêping would only introduce some of the operations carried out on plantations into the preparation of collected rubbers. The question, in short, resolves itself into considering whether, since manufacturers state that in present circumstances it is impossible for them to do the work, the exporters ought not to think of doing it themselves. In this case the crêping of African rubber should be done before it is placed on the market. The following operation would have to be carried out:—

(1) *Cutting up.* — by means of a toothless circular saw revolving

at high speed under a jet of water, cutting up the blocks or masses of rubber into small pieces.

(2) *Soaking and softening.* — immersion of the cut up rubber :— (a) in cold water ; (b) in warm water for a length of time varying according to the kind of rubber under treatment.

(3) *Crêping, washing.* — the pieces of rubber are crushed under a jet of water between two special cylinders of a rolling mill; the impurities contained are thus mechanically carried off ; the operation is continued until perfect purity is obtained and the crêpe so formed has reached a suitable thickness determined by greater or less space between the cylinders which are adjustable.

(4) *Drying.* — the crêpe obtained by crêping is hung up in a specially conditioned place ; different methods for drying can be used, causing more or less rapid elimination of the moisture in the rubber ; a preliminary drying in the air before the rubber is placed in the drying chamber will reduce the moisture in it to a great extent.

Rubber resulting from this series of operations appears to be identical with brown plantation crêpe. The practice of crêping can be regarded in two different ways :—

(1) The only object is to place on the market an African rubber in a pure form.

(2) In addition, the creation of "botanical standards" in African rubbers is aimed at, e. g. Landolphia type, Funtumia type, etc., each of these types being clearly characterised by its physical and chemical properties which indicate them more particularly as raw material suitable for a given manufacture.

The author examines the possibility of creping from a commercial standpoint, the conditions of installation of a creping factory (in Africa, or better still in Europe), description of the working of the factory, laboratory attached to the factory for scientific research.

In the 2nd part of his paper, the author indicates shortly what conclusions, he has arrived at after a preliminary investigation carried out at the laboratory of the Colonial Institute on rubbers which had reached Marseilles ; but he could not determine a certain number of points except during his mission in West Africa.

The 3rd part of the report is devoted to the enquiry which he made in England before he embarked, from makers of rubber machinery and from large manufacturers who have specialised in the purifying of crude rubbers in that country.

120 – **"Cay-Doc" Gum from Tonkin (*Garcinia tonkinensis*).** — HEIM, F., in *Bulletin de l'Office Colonial*, Year XII, No. 138-139, p. 413-424. Paris-Melun, June-July, 1919.

A previous paper (1) was devoted to the oil of " Cay-Doc," or " Cay-Gioc " (*Garcinia tonkinensis* Vesque), belonging to the Guttiferae of Tonkin, used by the Annamites for making soap and from which French indu-

(1) See *R.*, Sept. 1917, No. 854 (*Ed.*

stry might derive much profit. The "Cay-Doc" not only provides, in its seeds, a source of oil but it also yields a gum capable of industrial use.

At the request of M. CAPUS, Delegate for Indo-China at the Colonial Office, the Governor General of Indo-China sent a sample of the gum produced by *Garvinia tonkinensis* for examination by the "Service des Productions coloniales,, of that Department. The Annamites consider that it conduces to fruiting if notched incisions are made in the bark of the tree, even on the lower part. From these notches the tree exudes fairly large amounts of gum which is seldom collected for want of a definite use.

The "Cay Doc" abounds in Tonkin in the Provinces of Phu-Tho, Tahi-Ngunyen, Tuyen-Quang, Yen-Bay, Hua-Binh, and these forests can supply large quantities of the gum at a low price. The gum has the appearance of a blackish mass, fairly hard, becoming soft between the fingers to which it soon sticks. The surface is shining. Inside the specimen, agglomerations of a sticky substance, translucid and citron yellow in colour, are found. The odour of the gum, scarcely noticeable in a block which has been exposed to the air, is stronger on a fresh section, and recalls that of oil of sweet almonds. At 60° C. the gum melts partially giving out a thick, dark brown reddish liquid in which solid black matter is immersed. On cooling the liquid portion congeals in a vitreous glaze, shining and brittle. The author gives a detailed account of the physical and chemical properties of the gum of *G. tonkinensis*.

The gum, as received by the author, contained much vegetable impurities, with a blackish brown resin which is easily separated by taking advantage of its high degree of solubility in benzine or in acetone.

This resin exists in the crude gum in the proportion of 74.2 %; the true gum forms 25.8 %.

Hydrolytic examination of the carbohydrates shows that the galactanes are almost the only ones which enter into the composition of the true gum. These galactanes are but slightly condensed and are broken down by weak hydrolysis. The pentosans are represented in this gum by arabane, but in a slight percentage; a little preformed free glucose is found in it.

The gum of "Cay-Doc" has been considered of much interest to manufacturers of products for dressing and printing textile fabrics; it gives, not a solution, but rather a kind of mucilage, prepared by heating under pressure, with or without the addition of hydrogen peroxide. Trials are being made in finishing works. Trials of its use in the paper making and cardboard industry will be made as soon as a large quantity ordered from Indo-China arrives.

121 – **Drying Fruit, Experiments in Indo-China.** — MIÉVILLE, R., in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 8, pp. 233-238, Saïgon, Aug., 1919.

Drying is the most economical method of preserving fruit, because it requires neither receptacles nor special liquids.

The author describes the experiments in drying fruit which he carried out in Indo-China; the drying was done by the sun alone, by combined action of the heat of the sun and artificial heat, and by the action of artificial heat alone.

He thinks that it is possible to increase the orchards of fruit trees without any fear of over production of fresh fruit, for dried fruit would easily find a market. The benefits, from domestic economy and commercial standpoints, which can be derived from the dried fruit industry in temperate countries and tropical colonies are undeniable. The author has the firm belief that in the near future Indo-China will take a conspicuous place in this industry.

122 – **Antiseptic Action of Spices in Preserved Foods.** — LAHACHE, JEAN, in *L'Industrie française de la Conserve*, Year V, No. 29, pp. 211-214. Paris, Aug. 1919.

The author gives an account of investigations on the antiseptic action of spices in preserved foods. All this subject is, so to speak, in its infancy, and will be continued. But already attention should be drawn to the preliminary results obtained, which establish absolutely the antiseptic action of certain spices. The spices most generally used are black pepper, Cayenne pepper, ginger, mustard, cinnamon and cloves. The first three, in the experiments, only prevented fermentation and putrefaction for a very short time. But mustard, cinnamon and cloves (whose antiseptic principles are their essential oils) are much more effective. They are powerful antiseptics, even in the small quantities, in which they are used in food industries. Anyhow, these spices have an antiseptic action decidedly greater than that of the usual chemical antiseptics of which, moreover, the use is expressly prohibited by French law, while that of spices is legally permissible and is in no way contrary to hygiene.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

123 – **New Constant for the Investigation of Partial Skimming of Milk.** — LEDENT. RENÉ, in *Annales des Falsifications et des Fraudes*, Year XII, No. 129-130, pp. 219-225. Paris, July-Aug., 1919.

Communication to the "Society of French Chemical Experts".

As the fat content of milk varies between wide limits (2 - 3 - 6 %), adulteration by partial skimming is sometimes difficult to prove.

In 1914, M. VANDAM (Director of the Central Laboratory for the Prevention of Fraud, at Brussels) gave the results of the research which he had made with the object of establishing a constant enabling partial skimming to be proved, by taking as basis the proportion between the casein (c) and the fat (g) (1).

According to this investigator this proportion varies :—

from 0.53 to 0.72 for milk with over 40 % of fat
from 0.56 to 0.85 for milk with from 3 to 4 % of fat
from 0.67 to 0.98 for milk with from 2 to 3 % of fat

these figures having been established after examination of 144 samples of pure milk.

Skimmed milk shows a proportion $\frac{c}{g}$ greater than unity.

The great importance of this new constant in the investigation of partial skimming of milk, has led the author to undertake trials on pure milk of known origin.

(1) See *Annales des Falsification et des Fraudes*, April, 1914. (*Ed.*)

The skimming, although it only lowers the fat content and only modifies very slightly the percentage of the other elements, seems to increase slightly CORNALBA'S figure. The author thought that it might perhaps be possible to restrict the limits established by M. VANDAM for the proportion $\frac{c}{g}$ by introducing into this latter CORNALBA'S factor.

By establishing the proportion $\frac{\text{Cornalba}}{cg}$ or $\frac{\text{Cornalba}}{\text{Vandam}}$ which he calls $\frac{C}{V}$, the author has noted that the figures obtained fluctuate between very narrow limits. He gives in tabular form the figures which he obtained in the course of his experiments, and which led him to the following conclusions :—

Milk with high fat content, lightly skimmed, shows a $\frac{C}{V}$ not denoting this skimming but nevertheless possessing a reasonable food value.

The proportion $\frac{C}{V}$ would give, on the contrary, good results for the investigation of skimming in ordinary milk with low fat content. This kind of milk puzzles the chemist who has to deduce conclusions. As for the proportion $\frac{c}{g}$ it was, in certain cases, greater than unity.

124 – **The Comparative Value of Quantitative and Qualitative Bacteriological Methods of Testing Milk ; the Methylene Blue Reduction Test.** — HASTINGS, E. G., (Bacteriological Laboratory, University of Wisconsin, Madison), in *Journal of Dairy Science*, Vol. II, No. 4, pp. 293-311. Baltimore, July 1919.

The value of bacteriological analyses in the dairy industry has been established beyond all question. In all routine examinations the disease-producing organisms may be omitted from consideration and attention need be directed only to those saprophytic organisms which grow in the milk and change its composition. Four methods for the determination of the number of bacteria present in milk have been used to a greater or less extent : — (1) Plate culture.; (2) direct microscopic count.; (3) FROST'S method, called the "little plate" method, which is a combination of the two former; (4) The methylene blue reduction method, based on the fact that the colour imparted to milk by the addition of a small quantity of methylene blue disappears more or less quickly according as the bacterial content of the sample is low or high. This last method has the advantage of being the quickest, the easiest and the simplest of all, bnt it remained to be proved whether it h d th same accuracy.

The author has tried to solve this question by carrying out a series of tests, the results of which enable him to conclude that, both for raw and pasteurised milk, the methylene blue reduction test gives just as accurate results as any of the other testing methods.

125 – **Buttermilk Cheese.** — RUDNICK, A. W., in *Journal of Dairy Science*, Vol. II, No. 1, pp. 41-45, 1 fig. Baltimore, Jan., 1919.

Work done at the Iowa Agricultural Station, United States.

The author has ascertained that a cheese of satisfactory quality can be made from buttermilk derived from butter-making with pasteurised

cream, by running the buttermilk through one of the centrifugal machines now on the market for extracting the curd from skim milk in the manufacture of "' cottage-cheese " (1).

The machine consists of a hollow cylinder open at the top except for a rim 1/8 of the diameter of the cylinder ; the cylinder is supported by a spindle and enclosed in an iron frame. The curd lodges under the rim.

The casein content of the buttermilk depends on the acidity, temperature to which it is heated and the time during which it is held at that temperature. When pasteurised buttermilk containing 2.69 % of casein was held at 170° F. for one hour, the whey contained 0.266 % of casein When the buttermilk was held for one hour at 140° F. the whey contained 0.319 % of casein and when the buttermilk was heated to 170° F, but not held at that temperature, the whey contained 0.397 % of casein. The curd had more grain when the buttermilk was held for one hour at 140° F.

Buttermilk cheese made by the centrifugal process has not the disagreeable flavours which such cheese has when made in the ordinary way by neutralization with caustic soda and re-acidifying with hydrochloric acid.

The centrifugal process leaves only 0.15 % of casein in the whey if buttermilk from pasteurised sweet cream is used. This buttermilk, held at a temperature of 95° — 115° F for an hour after the acidity had reached 0.065 %, produced a cheese equal, in flavour and texture, to cottage-cheese.

126 – **The Chemical Investigation of Spoiled Meat.** — I. Falk, K. G., Baumann, E. J., and McGuire, G., in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 4, pp. 525-546, 9 fig. Baltimore, Apr., 1919. — II. Falk, K. G., and McGuire, G., Ammonia Test for Meat Spoilage, *Ibid.*, pp. 547-550.

I. — Most of the investigation described by the authors were made with meat or meat broth inoculated with micro-organisms isolated from meat and thought to be responsible for actual cases of poisoning. The general method employed was to study the chemical changes caused by the micro-organism under investigation in the following components : Total nitrogen ; non-protein nitrogen ; ammonical nitrogen ; nitrogen in the form of creatins ; nitrogen in the form of purin. Most of the micro-organisms belonged to the colon-typhoid group ; for comparison, the authors used *Streptococcus brevis* and the spore-forming *Bacillus subtilis*.

The results given in tubular form show some marked differences as well as similarities in the action of different groups of micro-organisms, which indicates that the bacteria exert certain selective actions on defined substances or groups of substances. The increase in the ammonia content was a constant factor the significance of which is discussed in the following paper.

II. — The marked increase of ammonia content in meat decomposing

(1) " Cottage-cheese " or " Pot-cheese ", names under which fresh curd, generally mixed with milk or cream, is known in the United States. — Cf. *Standard Dictionary of the English Language*, Vol. II, p. 324. New York, Funk & Wagnalls C., 1910. (*Ed.*)

at ordinary temperatures pointed to the possibility of using that factor as a chemical test in investigating meat spoilage. The determinations of ammonia were made according to the aeration method and according to FOLIN and BELL's method (1) on samples of beef undergoing decomposition at room temperature or at a low temperature.

At ordinary temperatures bacterial growth was rapid, especially at the higher temperatures, and the meat soon became unfit for use, in some cases after 24 hours. At low temperatures, there was a considerable growth of mould and little bacterial growth, but after cutting off the thin superficial layer infested by the mould, the meat was still usable after standing for 3 or 4 weeks at a temperature varying between 0° and 5° C. and for much longer at still lower temperatures.

The ammonia content of the two forms of spoiled meat was very different. The fresh meat (beef within 24 hours of slaughter and refrigeration), contained between 0.03 and 0.10 mgm. of ammoniacal nitrogen per gramme of meat. The meat decomposed at ordinary temperatures (15-25° C.) became unsuitable for food when the ammoniacal nitrogen content reached 0.3 to 0,4 mgm. per gramme of meat. At low temperatures the ammonia content was much higher before the meat became unsuitable as food ; it varied between 1 and 3 mgm. per gramme.

The authors refer to the works of HOAGLAND and his collaborators (R. HOAGLAND, C. N. MCBRYDE and W. C. POWICK, *United States Department of Agriculture, Bulletin* No. 433, 1917) who considered that the increase in amino-nitrogen was the best way of measuring the extent of autolysis in meat in cold storage, and remarked that at ordinary temperatures the growth of bacteria is relatively rapid and that the meat becomes unsuitable for food even with a low ammonia content. At low temperatures bacterial growth is slow, but autolysis proceeds in such a way that the products of decomposition such as ammonia and the compounds rich in amino-nitrogen increase greatly without the formation of those products, whose odour, appearance and flavour, render the food unsuitable for use. If the meat is kept cold first, autolysis proceeding, and is then brought to an ordinary temperature, decomposition would be much more rapid, because simpler products are formed by autolysis which would serve as nutriment for bacteria and would greatly increase their growth. This is perhaps, in addition to the physical effects of the rupture of cell walls by freezing, a reason for the more rapid decomposition of meat which has been for some time in cold storage.

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(1) O. FOLIN and R. D. BELL, *Journal of Biological Chemistry*, Vol. XXIX, p. 329, 1917. The ammonia is extracted from a solution by means of permutit (zeolite composed of silicate of alumina), specially prepared. The ammonia is then set free by a fixed alkali and determined by Nessler's process. The method eliminates the possibility of decomposition (by the alkalis) of the protein or any other matter present, and its results indicate better the quantity of ammonia or ammonium salt present in the meat. (*Author's note*).

127 – **Tripoli Wools and Means of Improving Them.** — CASELLI, A., in *Bollettino dell'Industria laniera*, Year XXXIII, No. 8, pp. 158-161, Biella, Aug. 31, 1919.

Given its natural conditions, Tripoli is much more suited to the breeding of flocks than to agriculture, and, owing to the coarseness of its fodder flora, especially that of sheep and goats. Before the war Tripoli exported anually abont 100 000 sheep, especially to Alexandria (Egypt) and only a small number to Malta and Italy The total number of sheep in Tripoli certainly exceeds one and a half million head. On an average the flocks number 300 to 400 head.

Except the Sudanese sheep, bred in the Sonthern part of Tripoli, the rest belong to the Syrian breed, Barbary variety, with fat tails, covered with wool over the whole body, except part of the head, the legs, and the front part of the tail. If these sheep were kept with care and protected from skin diseases, they would give a very fine fleece, but the carelessness with which they are kept often makes the wool coarse. The wool which comes from the eastern part of Tripoli is more valued than that from the western part. An animal in good condition of health and feeding gives 3 to 4 kg. of wool ; in exceptional conditions it may give 6 or more.

Shearing is done in an irrational manner, with imperfect instruments (scissors), and without grading according to quality. Wool is sold in the market at 80 fr. a quintal, if it is dirty, and 240 fr. a quintal, if it is washed and of good quality. The loss of weight in washing thoroughly varies from 55 to 56 %.

The examination of 8 samples of sheep's wool, from the districts of Tarhuna and Cussabat, gave : — Length of staple 6 to 9 cm. : loss by washing in water 43 to 55 % loss of wool washed in ether 8.7 to 11.5 %. The examination of 8 samples of wool from Msellata gave : — Weight of fleece before washing 2.7 to 4.1 ; after washing in cold water 1.000 kg. to 1.80 kg. ; loss in washing 1.6 to 2.5 kg. The fleece soils easily because it is open and the strands are conical ; it is chiefly particles of earth which soil it.

Tripoli wool is generally wanting in uniformity and is formed of strands of variable thickness, not only one strand with another, but also the same strand, which is sometimes thicker at the base, sometimes at the extremity, or else shows strictures (corresponding to the dry season), which makes it easily broken in weaving. As regards length Tripoli wools can be classed among long or carding wools ; as regard fineness, althongh there is room for improvement, they are not inferior to common Tuscan wools and second-rate cross-bred wools from Buenos Aires.

The examination of 15 samples, made at the technological laboratory of the Italian Colonial Agricultural Institute at Florence, has given the following average results : — *Wool from the shoulder* : — relative length of staple 13.3 cm. ; full length : — minimum 18.3 cm ; average 20.4 cm ; maximum 22.1 cm. ; diameter minimum 32.15 cm. ; average 45.15 cm. ; maximum 63.74 cm. ; stretching in mm per 100 mm : — minimum 21.76 : average 36.17 ; maximum 45.81 ; weight in gm. supported to breaking point: — minimum 8.3 ; average 15.4 ; maximum 30.6 — *Wool from the hindquarters*:

— relative length of staple 15.6 cm. — full length: — minimum 15.6; average 19.3; maximum 21.4 — diameter: — minimum 35.09 cm.; average 45.27; maximum 63.44 cm.; — stretching in mm per 100 mm: — minimum 22.93; average 35.33; maximum 47.97 — weight in gm. supported to the breaking point: — minimum 7.7; average 15.9; maximum 27.1.

As it has been seen, elongation is very marked (about 35 %), and even excessive for good weaving wool. The fleeces are often curly, but less than those of Merinos. When Tripoli wools are dry they do not absorb or hold a great quantity of water; on an average 10 to 15 %. In terms of comparison for Tripoli wools, the following data may be used (average of 8 samples), relating respectively to wools of the 1st and 2nd shearing of the cross-bred race Vissano-Maremmana × Bergamasca, which is considered a good breed for wool: — Full length 119.7mm. and 82.6mm.; diameter 35.3μ and 32.7μ; breaking strain 8.125gm. and 9.611gm. — stretching 25.62 and 22.97 %.

For improving the Barbery breed, crossing with European breeds cannot be relied on, as is shown by experiments made in the Algerian Sahel, and in certain regions of Tunis, where the produce of crossing with the Rambouillet-Mérinos breed did not stand the indigenous method of treatment, where that with the Soissons breed degenerated rapidly, and that with the Merinos of Crau gave inferior results to those of the local breed. Crossing with Sicilian or Sardinian sheep has been advised, but they yield less, and give a coarser wool than the indigenous sheep; the proof of this in that Barbery rams are imported into Sicily and Sardinia to improve the breeds. It only remains, therefore, to have resort to selection, which must aim first at production of wool and meat, and afterwards of milk. Useful technical improvements would be: — the use of shearing machines the washing of wool after shearing; the grading in different classes of wool, which is at present sold by entire fleeces; the founding of central markets.

128 - **Indo-Chinese Silks and Silk Goods at the Lyons Fair (France).** — *Bulletin des Soies et des Soieries*, Year XLIII, no. 2210, pp. 2-3, Lyon, Oct. 4, 1919.

The "Economic Agency of Indo-China" has organised in its stalls at the Lyon Fair a very complete exhibition of Indo-Chinese silks and silkgoods. Regarding raw silk, Indo-China produces a raw-material which, in the French market, could be used on equal terms with "Canton silk" and might even be superior to it.

Under the influence of the French Administration, helped by experts, especially from Lyons, the natives gave up, by degrees, their crude processes and adopted more improved methods, which enable them to produce raw silks, exportable waste and textiles, welcomed by the market of Lyons.

The first changes, recommended by the Administration, regarding the breeding of silk-worms, plantation of mulberries, spinning, preparation of by-products, and weaving, have been adapted to local means and possibilities.

An entire series of samples and models of apparatus furnish a realistic demonstration of the continued efforts which have led Tonkin and Cambodia to take a place, which is still too modest, among the countries producing the silk required by the Lyon factories (1).

Besides native made-fabrics for local use, and new materials (of the tussore, shantung and pongée kind) for exportation, fabrics made and imported from China into Indo-China may be mentioned. The latter may be of interest to French manufacturers.

Lastly a superb collection of " sampots ", dyed and woven entirely by Cambodians, gave a very eastern appearance to this beautiful show.

AGRICULTURAL PRODUCTS; PRESERVING, PACKING, TRANSPORT, TRADE

129 – **Practical Conclusions regarding the Storage of Tobacco in Bales in Sumatra.** — DEN DOOP, J. E. A., in *Mededeelingen van het Deli Proefstation te Medan-Sumatra*, 2nd Series, No. III, pp. 1-18. Medan, 1919.

Tobacco from two different crops must never be put in the fermenting shed at the same time.

In storing tobacco in bales two processes may be used: —

(1) The tobacco is stored at a distance of 1 to 2 km. from inhabited buildings, in a drying-room with a raised floor.

(2) The tobacco is stored in a building which can be disinfected, with doors and windows covered with fine wire gauze.

Tobacco is never carried in bales from one storehouse to another unless it has been ascertained that it is free from *Lasioderma serricorne* (2).

For 2 or 3 weeks all the tobacco in bales is checked by 2 expert women, who search all day long for the adult the adult *Lasioderma* on the surface of the bales.

Every month a repacking is done, the bales which are the most likely to be moist being opened to see if the tobacco has been infested by the tobacco moth (*Setomorpha margalaestriata*) (2).

130 – **Trial Shipment of Bulk Wheat from Vancouver via the Panama Canal to the United Kingdom.** — BIRCHARD, F. J. and ALCOCK, A. W., in *Department of Trade and Commerce, Canada* (Dominion Grain Research Laboratory), *Bulletin* No. 1, pp. 1-20. Ottawa, 1918.

Since the opening of the Panama Canal the possibility of shipping bulk wheat from Canada to Europe by this route has been discussed a great deal. It was the opinion of many that the conditions to which the grain would be subjected in the tropics would be found too severe for Canadian grain, and that there would be a grave danger of cargoes arriving at their destination in a heating condition. The Department of Trade and Commerce therefore decided in 1917 when sending a trial shipment that the laboratory should make a thorough investigation of the question.

(1) See *R.*, June 1918, No. 676; *R.*, Nov. 1918, No. 1264; *R.*, Oct.-Dec. 1919, No. 1212 (*Ed.*).
(2) See *R.*, Dec. 1918, No. 1436, and *R.*, Jan. 1919 No. 142 (*Ed.*).

The authors describe in this bulletin the results of their investigations, and give numerous explanatory tables and diagrams. The wheat for this shipment was collected from various points in western Alberta, and was subjected to the necessary analyses for grade, percentage of moisture and weight. The SS. *War Viceroy* was loaded with 99.209 bushels of wheat of 7 different types in such a way that each type which on analysis showed given characteristics formed a layer of the cargo. The vessel was of steel and had wooden flooring and sides in the holds. Without going into details about the method of loading and the arrangement of the cargo in relation to the construction of the ship, the following are the main conclusions arrived at by the Commission in charge of the investigation :—

The chief result is that wheat may be carried from Canada to Europe via the Panama Canal without damage, if the following precautions are taken :

Only wheat which is quite sound in every way should be shipped by this route ; it should be carefully tested for moisture and any lots containing an excessive amount should not be loaded into the vessels. It has not been possible to determine just how much the grain may safely carry, but until some limit is definitely set, a moisture content of more than 14.5 % should be regarded as dangerous.

The temperatures recorded by the thermometers against the false bulkheads near the engine room and stokehole are evidently too high for safety and an unventilated air space of 9 to 12 inches cannot then be considered sufficient protection. When it is necessary to stow grain close to the engine room or stokehole, these spaces should be either ventilated or extended. The records clearly show that it was only in these portions of the holds and close to the propeller shaft tunnel that dangerously high temperatures occurred. The general conditions vary in the different types of ships, but by taking sufficient precautions in the above mentioned respects there will be little difficulty in carrying wheat cargoes safely from Canada to Europe via the Panama Canal.

131 – **American Cotton Seed and Cottonseed Products.** — *United States Commerce Reports*, No. 196, p. 962. Washington, D. C., Aug. 21, 1919.

A preliminary report of the United States Bureau of the Census gives the quantity of cotton seed received at American mills during the 12 months from August 1, 1918, to July 31, 1919, as 4 450 189 tons, contrasted with 4 260 290 tons during the previous year. This does not include 40 438 tons and 31 828 tons on hand on August 1, nor 146 271 tons and 208 358 tons reshipped or burned for 1919 and 1918, respectively. There were 4 366 028 tons of seed crushed during 1919, against 4 251 680 tons during 1918, and 24 599 tons on hand on July 31, 1919, against 40 438 tons on the corresponding date of 1918.

Cottonseed products manufactured, shipped out, and on hand were as follows : —

Item	Year	on hand Aug. 1	Produced Aug. 1 to July 31	Shipped out Aug. 1 July 31	on hand July 31
Crude oil . . . . . pounds	1919	*a*) 16 503 655	1 320 249 788	1 322 507 336	*a*) 25 681 360
	1918	15 477 352	1 312 471 125	1 314 756 603	16 503 655
Refined oil . . . . . do . .	1919	*b*) 265 875 255	*c*) 158 864 979	—	*b*) 146 719 782
	1918	298 757 126	1 188 213 854	—	265 875 255
Cake and meal . . . . . tons . .	1919	28 751	2 158 888	2 141 664	45 975
	1918	02 540	2 067 977	2 131 766	28 751
Hulls . . . . . do . .	1919	60 425	1 123 879	1 063 992	120 312
	1918	56 016	996 065	991 656	60 425
Linters . . . . . 500 pound bales	1919	30 868	928 913	706 055	253 726
	1918	102 754	1 130 422	1 202 308	30 868
Hull fibre. . . . . do	1919	11 609	130 122	97 174	44 557
	1918	6 853	1-3 663	328 907	11 609
Grabbots, motes, etc. do	1919	12 453	31 480	32 563	11 370
	1918	9 703	56 559	53 809	12 453

a) Includes 3 171 885 and 13 962 704 pounds held by refining and manufacturing establishments and 6 433 196 and 7 077 530 pounds in transit to refiners and consumers Aug. 1 and July 31, respectively.

b) Includes 10 821 959 and 4 569 701 pounds held by refiners, brokers, agents and warehousement at places other than refineries and manufacturing establishments, and 14 230 077 and 7 614 431 pounds in transit to manufacturers of lard substitute, oleomargarine, soap, etc. on Aug. 1 and July 31, respectively.

c) Produced from 1 296 420 913 pounds of crude oil.

During the year ending July 31, 1919 there were imported into the United States 19 057 236 pounds of cottonseed oil, as compared with 16 967 737 pounds during the previous year. Exports of cottonseed products consisted of 174 269 424 pounds of oil, against 109 437 949 pounds; 169 791 tons of cake and meal, against 19 051 tons; and 71 534 running bales of linters against 187 704 bales.

132 - **Exportation of Henequen from Yucatan.** — ROWE, J. W., in *United States Commerce Reports*, No. 111, p. 787. Washington, D. C., 1919.

The total exportation of henequen (1) from Yucatan for the year 1918 is estimated at 600 000 bundles and is valued at 48 000 000 pesos (1 peso = $0.50 United States Currency). For 1919, it is expected that the output will be even greater, owing to the fact now that markets have been opened in various parts of the world, notably in Argentina, where the fibre is used in the manufacture of grain bags.

The henequen commission recently sent a trade commissioner to

(1) Henequen is the fibre of *Agave rigida* var. *elongata*, whilst sisal is the fibre of *Agave rigida* var. *sisalana*. (*Ed.*)

Argentina for the purpose of studying the market there as well as to investigate generally the possibilities of trade between the southern Republic and Mexico. It placed orders, while there, for 50 000 sacks of hennequen and the commission has already dispatched one vessel of its fleet with a cargo of sisal. On its return trip this ship is bringing a cargo of wheat.

The commission is not only concerning itself with the exportation of the raw fibre, but has established factories for the manufacture of sacks and twine, which articles, it is expected, will presently figure extensively among the exports of the State of Yucatan.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

RESISTANT PLANTS

133 – **North American Varieties of Oats Liable to Rust and South American Varieties Resistant to this Disease.** — See No. 28 in this *Review*.

134 – **A Cocoa Plant Proof against "Krulloten" (*Marasmius perniciosus*), in Surinam.** — See No. 35 in this *Review*.

MEANS OF PREVENTION AND CONTROL

135 – **Chemical Investigations on Agents for Combating Fungoid Diseases and Insects.** — 1) Mond, R. L. and Heberlein, C., in *Journal of the Chemical Society*, Vols. 115-116, No. 682, pp. 908-922, Figs. 2. Pl. I. London, Aug. 1919. — 2) Ramsay, A. A., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Pt. 6, pp. 428 — 429. Fig. 1. Sydney, June, 1919.

I. The Chemistry of Burgundy Mixtures. — The mixtures of sodium carbonate and copper sulphate which are the constituents of the above have proved most effective for combating plant diseases of a fungoid character. However, in spite of the highly significant work which has been done by Pickering and Ravaz the authors considered the problem more complicated than the former had assumed, and proceded to carry out investigations on the following lines: 1) The main reactions between copper sulphate and sodium carbonate quantitatively studied with various ratios of the components; 2) the reaction between copper sulphate and sodium hydrogen carbonate; 3) the estimation of the amount of free carbon dioxide and the carbon dioxide in the precipitate, and the ratio cupric oxide CuO: carbon dioxide CO in the precipitates; 4) the solvent action of carbonic acid; 5) the determination of the basic sulphate in various mixtures to ascertain the ratio cupric oxide CuO: sulphur trioxide SO_3 and CuO: CO_2: SO_3; 6) the estimation of the absorbed sodium carbonate; 7) investigations as to the causes and reactions of the change from the colloidal precipitate to malachite.

On mixing copper sulphate with sodium carbonate solution, three distinct copper compounds are formed :— 1) insoluble hydrated basic copper carbonate, which forms the bulk of the precipitate; 2) insoluble hydrated basic copper sulphate; 3) soluble basic copper sulphate. Complete conversion of copper sulphate into these salts is obtained when for 4 gm. of crystal-

lised copper sulphate, 4.25 gm. of crystallised sodium carbonate (Na_2CO_3 10 H_2O) is added. From the results obtained, there appears to be no well defined compound, the composition altering according to conditions of precipitation. All the compounds are subject to rapid changes, the basic copper carbonate losing carbon dioxide and the dissolved basic copper sulphate soon becoming insoluble.

A 1 % mixture made at 15° C, in 200 litres of water gives :— *a*) basic copper carbonate with CuO and CO_2 in the ratio 2:2 : 1 ; *b*) insoluble basic copper sulphate containing CuO and SO_3 ; ratio 15 : 1 ; *c*) soluble basic copper sulphate equal to 9.6 % of the total copper present ; *d*) free carbon dioxide is evolved equal to 52.4 % of the total carbon dioxide present in the sodium carbonate.

At a higher temperature more carbon dioxide is evolved, until on reaching boiling point, all is expelled and the precipitate is converted into black copper hydroxide.

The whole of the copper precipitate including the normal is at first colloidal sodium carbonate, but the presence of free copper sulphate, sodium hydrogen carbonate, or carbonic acid in the mixture accelerates the change to the crystalline state.

The dissolved basic copper sulphate is in the form of hydrosol.

Changes in the sulphur content of the copper precipitate also take place during the change of the colloid to the crystalloid. The crystalline precipitate contains less carbon dioxide than the colloid. The ratio of CuO : CO_2 in old cristalline precipitate was found to be 2.94 : 1.

The amount of basic copper sulphate formed decreased as the amount of sodium carbonate used was increased ; the free carbon dioxide acts as a solvent on the basic copper sulphate only, not on the basic copper carbonate. The maximum of soluble basic copper sulphate is obtained in a mixture of 4 gm. of copper sulphate and 4.45 gm. of crystallised sodium carbonate and the minimum with 7.38 gm. of the latter. The copper precipitate at 15°C. contains absorbed sodium carbonate in the ratio CuO : Na_2CO_3 = 74 : 1. The whole of the copper precipitate is at first colloidal, and then the gel changes gradually into the crystalline state.

From the results obtained in this research the fact that the chemistry of Burgundy mixture is of a much more complex nature than previously suspected, is confirmed, and there are a number of questions which have to be further elucidated. The nature of the colloid solution, the conditions of its formation and the change to the crystalline state await further investigations, and also the influence produced by small quantities of glue. These all indicate the importance of making further experiments with similar colloids.

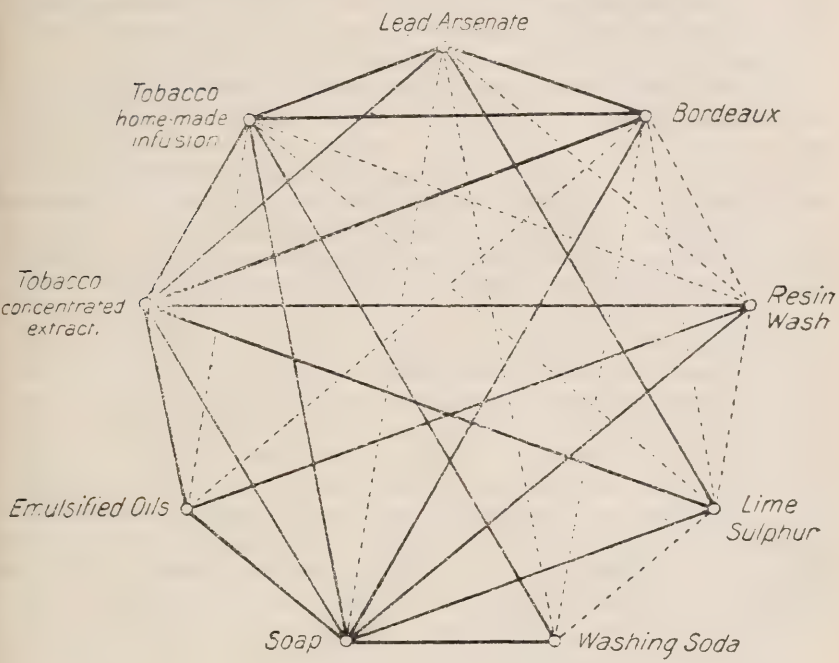
II. The mixing of sprays. — The question of combining insecticides and fungicides in the treatment of orchard pests is attracting more and more attention, for the obvious reason that such combinations may represent substantial savings both in time and money.

The diagram is supplemented by the table indicating what mixtures may safely by made and also the unreliable sprays.

Table of Compatible and Non-compatible Sprays.

Spray	May be mixed with—	Must not be mixed with—
Alkali sulphides (liver of sulphur)	Soap, washing soda	Bordeaux, Burgundy, lead arsenate, Paris green.
Ammonia copper carbonate	Tobacco infusions, concentrated tobacco extracts	Bordeaux, Burgundy, lead arsenate, Paris green.
Bordeaux mixture	Lead arsenate, Paris green, concentrated tobacco extracts, tobacco infusions soap	Alkali sulphides, lime-sulphur, certain oil emulsions, resin wash washing soda.
Burgundy mixture	Concentrated tobacco extracts	Alkali sulphides, lead arsenate, lime sulphur, Paris green, resin wash, soap, washing soda.
Ferrous sulphate and sulphuric acid	To be used alone	
Iron sulphide	Bordeaux, lime-sulphur	
Lead arsenate	Bordeaux, lime-sulphur, sulphur (atomic), concentrated tobacco extracts, tobacco infusions.	Ammonia copper carbonate, alkali sulphides, resin wash, soap, tobacco infusions, washing soda.
Lime-sulphur	Iron sulphide, lead arsenate, concentrated tobacco extracts	Bordeaux, Burgundy, resin wash, soap, tobacco infusions, washing soda.
Paris green	Bordeaux, concentrated tobacco extracts.	Alkali sulphides, ammonia copper carbonate, resin wash, soap, washing soda.
Resin wash	Kerosene emulsion, concentrated tobacco extracts	Bordeaux, Burgundy, lead arsenate, lime-sulphur, Paris green, tobacco infusions.
Soap	Alkali sulphides, Bordeaux, tobacco infusions concentrated tobacco extracts, resin wash, washing soda.	Burgundy, lime-sulphur, lead arsenate, Paris green.
Sulphur (atomic)	Lead arsenate, Paris green.	
Soap-oil emulsions.		Lead arsenate.
Tobacco extracts, concentrated	Ammonia copper carbonate, Bordeaux, Burgundy, lead arsenate, lime sulphur, oil emulsions, resin wash, soap, tobacco infusions, washing soda	
Tobacco infusions	Ammonia copper carbonate, alkali sulphides, lead arsenate, soap, concentrated tobacco extracts, washing soda.	Lime-sulphur, lead arsenate, Paris green.
Washing soda	Alkali sulphides, emulsified oils, soap, concentrated tobacco extracts, tobacco infusions.	Burgundy, Bordeaux lead arsenate, lime-sulphur, Paris green.

Diagram indicating the Compatibility and Incompatibility of Orchard Sprays:



Circles connected by a thick black line may be mixed together.
Circles connected by a dotted line *should not* be mixed together.

136 – **A New Anti-Fungoid Mixture for Vines.** — See No. 145 in this *Review*.

137 – **Patents for the Prevention of Diseases and Pests of Plants.** — See No. 110 in this *Review*.

138 – ***Bacterium Solanacearum* Injurious to Beans in Florida, United States.** — SMITH, F. and MCCULLOCH, L. in *Science*, New Series, Vol. L, No. 1288, p. 238, Lancaster, Pa., Sept. 5, 1919.

DISEASES OF VARIOUS CROPS

In June, 1919, the authors received for examination some badly diseased bush beans from Lynn Haven, Florida. The leaves were wilted and more or less brown. Often the petioles also were brown and wilted to their base. The roots were brown and the epidermis somewhat decayed in places. The woody parts of the plant, both stems and roots, had dark stained vascular bundles. Cross sections examined microscopically showed from 50 to 100 per cent. of the vessels to be full of bacteria and no fungi were visible. As the discolouration of the leaves was generally uni-

form, with no lesions apparent, while the roots showed lesions and contained bacteria in great numbers, the supposition was that the disease must be due to the bacteria and that they must have entered through the root system. The loss in the Florida field was about 20 % of the beans planted.

Agar-poured plates gave pure cultures of a white bacterial organism having all the characteristics of *Bacterium solanacearum*.

Cultural work in other media and needleprick inoculations made with sub-cultures of colonies taken from the poured plates confirmed this diagnosis.

A number of different legumes was inoculated by pricking the bacteria into the stems. Of beans, Waxbush, Red Valentine and Refugee proved very susceptible. These plants began to wilt two days after inoculation and a number were entirely wilted and fallen over in 7 days. In addition, good infections were secured in Lima beans (Fordhood variety), Pinto beans (a brown speckled variety) and Great Northern (a white Navy bean).

Inoculated in peas, this parasite acts more slowly than in beans, but it is not without pathogenic properties at least in some varieties. Following stem inoculation there is a slow drying and shrivelling of the leaves, but not a sudden wilt. The plants become stunted. Cross sections of the stems show bundles discoloured and containing bacteria, though in less abundance than in infected beans, tobaccos, or tomatoes. Telephone, Little Marvel and Mammoth Luscious Sugar were the varieties of peas that became infected. The organism has been re-isolated from both beans and peas, and proved to have the same characters and infectiousness (tested on tobacco and beans), as the original culture.

The organism was also found to be infectious to soya beans (variety Sto San) and to cowpeas (variety Black Cow).

Tobacco and tomato plants used for control showed typical *Bacterium solanacearum* infections.

So far as known, this is the first time the disease has been observed in beans, peas, soya beans or cowpeas, although known to occur in groundnuts, in *Mucuna* sp. and in some other legumes. Fortunately, beans appear to be very susceptible only in the early stages of growth.

139 - ***Erisyphe Risi* (=*E. communis*), Injurious to Peas, in Brazil.** — See No. 28 in this *Review*.

140 - ***Podosphaera Oxycanthae* var. *tridactyla*, an Erysiphe Injurious to the Bay Cherry, in Switzerland.** — FISCHER, ED., in *Schweizerische Obst-und Gartenbau-Zeitung*, No. 20, pp. 314-315, 1 fig. Munsingen, Oct. 15, 1919.

In a closed-in part of the Botanic Gardens at Berne there grow various large specimens of *Prunus Laurocerasus*. These were damaged by frost during the winter of 1918-19 and were severely pruned back, in consequence of which new shoots sprouted and were still growing even at the end of the succeeding summer. Up to August and September they showed young pale green leaves.

At the beginning of September, the author found that on many of these twigs the youngest and uppermost leaves were more or less shrunken up and coloured whitish yellow on their lower surface : in addition, they often kept exceptionally small. The lower side was covered with a white fungous layer, while the lower leaves with no change in their shape appeared to be only slightly or not at all affected.

The same alterations in the early stage were also observed by the author on a specimen of *P. Laurocerasus* growing in the open in another part of the Botanic Gardens ; this plant had also been cut back to near the stump and was already covered with new branches.

Further examination of the diseased leaves proved they were attacked by *Podosphaera Oxyacanthae* var. *tridactyla*, an erysiphe parasitic on different species of *Prunus*, even outside Switzerland, but apparently not yet widely reported, either in Switzerland or elsewhere, on *Pr. Laurocerasus*.

The unusual appearance of the fungus on the bay cherry might be explained, according to the author, by the fact that, in the cases studied by him, contrary to the usual, when the erysiphe was growing on other species of *Prunus* the bay cherry had leaves still in the tender state and on that account liable to infection.

As these conditions, however, only seldom occur, it is not likely even in the future that the disease can spread to a great extent on the bay cherry. This does not exclude the possibility that the fungus. once established on *P. Laurocerasus*, may subsist on it and by means of hibernating perithecia or by the hibernating of its mycelium inside the buds attack also the young wood growing at the normal period. It is adivisable therefore to remove and destroy the young diseased twigs and see to the destruction of the leaves which fall from infected branches.

141 – **New Fruit Fungi Found on the Chicago Market.** — Turley, H. E., in *Science*, New Series, Vol. L., No. 1294, pp. 375-376. Lancaster, Pa., October 17, 1919.

Three new fruit diseases have been found on the Chicago market :— *Botrytis* sp. on apples, *Polyscytalum* sp. and *Fusarium* sp. on grapefruit.

Botrytis sp. was first isolated from Spitzenburg apples and later found on Arkansas Black and Winesap. Five Spitzenburg apples affected with the disease were taken from the same box. These affected apples were entirely rotted. They were very soft, but the rot was firmer than that produced by *Penicillium*. Within the author's knowledge no *Botrytis* of the description given by him from examination has ever been recorded. In the same culture tube occupied by this *Botrytis* the perfect stage of the fungus developed, but during the four months when it was kept under observation no ascospores were formed. Inoculation of Spitzenburg apples with conidiospores gave positive results.

Polyscytalum was found on the market only three times and as yet is not a disease of importance. The fungus was isolated from a slightly sunken soft area, of a little lighter colour than the grapefruit itself. In the early stages of the disease the rot works down to the pulp of the fruit in a perpendicular manner. The affected tissue is very soft, more so than

that attacked by *Penicillium*. When a spot produced by the action of the fungus has reached the diameter of 20 or 25 millimetres, the parasite begins to attack the pulp of the fruit, which soon all becomes a soft mushy mass. Positive results were obtained from inoculations.

Fusarium sp. was first found in a shipment of Florida grapefruit. The fungus was found enough on the Chicago market to classify it as a disease of economic importance. The isolation was made from a tan to reddish brown rough sunken area an inch in diameter. The tissue underneath was dry, corky, and of a tan colour extending inward. The spots often reach a greater size than that just indicated. In the case of the larger spots the fungus often develops down into the pulp of the fruit causing a rot. A very fine white cottony growth often develops in the pulp of the fruit and sometimes on the surface of the brown rough area. Inoculations carried out gave positive results. It has been shown that a *Fusarium* spot develops very slowly. However, in 50 % of the inoculations, when a spot had reached a diameter of 20-25 mm, a rot developed at the edge of the sunken area. When *Fusarium* acts in this manner it is very serious, for a grapefruit will be a worthless rotten mass within forty-eight hours after the rot has started.

142 – **Experiments with Tumours caused by Bacteria in Pines.** — DUFRENOY, J., in *Comptes rendus des séances de l'Académie des Sciences*, 2nd Half 1919, Vol. CLXIX, No. 12, (22 Sept. 1919), pp. 545-547. Paris, 1919.

At Bareges (in the upper Pyrenees Department), *Pinus sylvestris* and *P. Laricio* are deformed by resinous swellings of bacterial origin, identical with those on the maritime pine (1) and, as experiments have shown, transmissible from tree to tree.

The action of the *Coccus* on the pine, while at first stimulating, brings on the develpment of hyperplasia, cells filling up air spaces or canals, sacs especially on the border of medullary rays. Finally there follows the resinous liquidation of the tissues.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

143 – **Legumes of the Genus *Deguelia (Derris)* and Their Use in Checking Insects and Other Injurious Invertebrates.** — MC INDOO, N. E., SIEVERS, A. F., and ABBOTT, W. S. in *Journal of Agricultural Research*, Vol. XVII, No. 5, pp. 177-200. Washington, D. C., August 15, 1919.

The genus *Deguelia* Aubl. — synonymous with *Derris* Lour. — belongs to the leguminous family and includes several species already found to be insecticides or poisonous; the ground roots of one species, probably *Deguelia elliptica* (Wall.) Janb. — synonymous with *Derris elliptica* (Wall.) Benth. — are sold as an insecticide; *D. elliptica* is a strong fish poison and is much used in the East Indies for catching fish.

(1) See *R.* May 1918, No. 600. (*Ed.*)

Of the different insecticides on sale, some act on the stomachs of insects affected, others by contact; the authors show that powdered roots of *D. elliptica* and of *D. uliginosa* (DC) Baill. — syn. *Derris uliginosa* (DC) Benth. — act at the same time in both ways, but are of no value as fumigators.

The authors studied the following materials: — powdered roots of a species of *Derris*, probably *D. elliptica* bought on the market; roots of *D. elliptica* called "tuba,, or "toeba,, in the Dutch East Indies, from Buitenzorg (Java); stems of *D. uliginosa* from Suava (Fiji Islands); stems of *D. Koolgibberah* Baill. and of *D. oligosperma* from Brisbane (Queensland, Australia); roots of *D. scandens* Benth., and roots and stems of *D. robusta* Benth. from Sibpur (Calcutta, India).

On extraction with boiling denatured alcohol, they obtained from these substances the following percentages of extract: respectively 14.25,8.50-8.50, 10.30,22. 50,20.30,16.70 (roots of *D. robusta*) and 15.70 (stems of same species). Of the 6 species tried, only two, *D. elliptica* and *D. uliginosa*, were found satisfactory for use as insecticides.

Several writers state that the toxic principle of the *Deguelia* species is a resin that acts on the different classes of animals according to the development of their nervous system. It kills some insects easily, others with difficulty, but usually its action is slow and it apparently causes death by paralysing the motor organs. The extract obtained with denatured alcohol applied in the form of a spraying mixture has proved effective on certain aphidae (*Myzus persicae, Macrosyphum liriodendri, Rhopalosiphum pseudobrassicae, Aphis helianthi, A. gossypii, A. spiraecola*), and on larvae of *Leptinotarsa decemlineata* and the small caterpillars of *Hyphantria cunea*. It is possible to incorporate extracts of *D. elliptica* and *D. uliginosa* in soft soap; by simply dissolving them in plenty of water a solution ready for spraying. can be obtained.

It has been found that commercial *Derris* sp. powder as ordinarily used is efficacions against dog fleas (*Ctenocephalus canis*), chicken lice (several species of Mallophaga), the house fly, 3 species of aphis (*Aphis rumicis, A. pomi, Myzus persicae*), the larvae of *Leptinotarsa decemlineata* and the small caterpillars of *Hyphantria cunea*, but it is of no practical value against bedbugs (*Cimex lectularius*), roaches (*Blattella germanica*), chicken mites (*Dermanyssus gallinae*), mealy bug of lemon and orange trees (*Pseudococcus citri*), *Orthezia insignis, Tetranychus bimaculatus*, larvae of *Lepidosaphis ulmi*. Used as a powder in suspension in water, with or without soap, under practical conditions, it was effective against most of the aphides tried, and against the caterpillars of *Autographa brassicae, Datana ministra, Asinota senatoria, Malacosoma americana* and the larvae of *Leptinotarsa decemlineata*.

144 – **Chemical Studies on Insecticidal Products.** — See No. 135 in this *Review*.

145 – **A New Insecticide and Anti-fungoid Mixture for Vines.** — BERTHELOT, A., in *Revue de Viticulture*, Year XXVI, Vol. I, I. No. 1321, pp. 266-267. Paris, October 23, 1919.

In order to control at the same time animal and vegetable pests on

vines and to avoid also the drawbacks resulting from the use of lead, the author recommends the use of an intimate mixture of 448 parts trisodium arsenate with 74.9 of sulphate of copper in a suitabie volume of water. The ingredients of this solution are calculated so as to obtain a fairly neutral mixture. It is easy to vary at will the reaction of the mixture by altering the proportion of sulphate of copper, a slight excess of which would not be injurious.

Such a compound has been successively applied on a series of vineyards, mostly in the Aude and Haute Garonne, and the experiments were entirely satisfactory.

Used in increasing doses corresponding to 2,3 and up to 4 kg. of arsenate of copper per 100 litres, even in high concentration it causes no damage or burning to vegetation. It showed great adhering properties on leaves and grape-bunches.

The number of larvae destroyed was very great, and any surviving larvae were generally in a dying condition.

Naturally, in order to obtain quite satisfactory results, at leat two applications are necessary, one on the appearance of the insects (" cochylis " or " eudemis "), which coincides more or less with the flowering of the vines ; the other eight to ten days after. The strength of the mixture should be at the minimum rate of 20 gm. arsenate of copper per litre of water.

146 – **The Control of Locusts in the Capitanata, Italy** (1). — Paoli, G., in *La Propaganda Agricola*, 2nd Ser., Year XI, No. 15, pp. 184-187. Bari, 1919.

The locusts (*Dociostaurus maroccanus*) which multiplied in large numbers during 1919 in the province of Foggia (communes of Foggia, Ascoli Satriano and Troia) were combated by the author with sprayings and with poisoned bran.

When the insects were still in the wingless stage sprayings were carried out with a solution of arsenite of soda in proportions varying from 0.75 to 2 % according to the age of the insect. Eighty-six knapsak sprayers of the ordinary type used in treating vines and as recommended by the Ministry of Agriculture, were carried out for this purpose ; about 5000 hectolitres of solution and 75 quintals of arsenite of soda were used in 34 days. The effect of such spraying is very quick ; one hour after, most of the insects wetted by the jet are dead.

The bran was also poisoned with a solution of arsenite of soda in the proportion of 4 to 6 % ; it was moistened so as to make it absorb about its own weight of solution. In the mechanical preparation of this remedy, advisable in order to avoid all or nearly all the drawbacks involved in hand mixing, a special simple and compact apparatus was used as invented by the author and based on the principle of allowing the bran and the poisonous solution in fine subdivision to drop from a height so that they

1) See *R.*, Nov. 1918, No. 1311; *R.* Apr. No. 543. Cf. also *The Control of locusts in different countries* Internat. Inst. Agric., Rome, 1916. *passim.* (*Ed.*)

combined during the fall. The bran was spread by hand on columns of locusts. The mortality was extraordinary, beginning after a few hours and continuing for two or three days. The quantity of bran used in 1919 was 740 quintals.

An experiment executed by the author with zinc phosphide in powder form, scattered alone or mixed with wheat flour, on the herbage on which the locusts had to feed, with the ordinary blowers used to sulphur vines, showed that this method — which does not appear to have been used yet by others against insects in the open — might give useful pratical results if the phosphides were reduced to an impalpable powder and used against very young insects collected on slopes of short grass wet with dew. Compared with sprayings, phosphide offers the following advantages:— 1) Rapidity of application and consequent economy ; 2) suppression of water carrying, which costs most ; 3) diminution of labour required ; 4) possibility or even opportunity to work when the herbage is wet with dew or rain ; 5) phosphide does not dry up the grass, which thus remains always edible for the locusts.

The author also intended to try crushing the insects by compression using plough tractors, with very large wheels or ordinary rollers used for roadmaking, but this experiment could not be tried, no machine of the kind being to hand at the proper time.

147 - **Experiments in Checking the Migrating Cricket (*Schistocerca tatarica*) in Algeria** — BAZILE, G., in *Comptes rendus des séances de l'Académie des Sciences*, 2nd Half-year 1919. Vol. CLXIX, No. 12 (Sept. 22 1919) pp. 547-549. Paris, 1919.

The results are described of experiments made in Algeria (Department of Algiers) against *Schistocerca tatarica* with the flame-throwers and poison gases already used in France to keep down the Moroccan cricket (*Dociostaurus maroccanus*) (1).

Flame throwers (Army model P3). — In uncultivated districts the operator, kneeling, sweeps the ground occupied by the moving crickets with the flame jet. All insects reached by the flame or within a metre of the zone covered are instantly destroyed. Others further away move off, but with difficulty, and then are killed also. The crickets are destroyed either by the flame or by the heat only, or by the combustion products of the heavy coal oil.

The effectiveness of this method is still greater against insects at the transformation stage, as they move about less. Besides, the operator works in an upright position and makes more rapid progress. Shrubs infested with crickets receive two or three blasts of the flame, and when they catch fire they increase and prolong the action of the treatment. Practically no insects escape destruction.

The treatment was carried out in the morning very early, so as to catch the insects while still numbed by the coolness of the night.

In six days several million insects were destroyed.

(1) See *R.*, July-Sept., 1919, No. 1049, (*Ed.*).

To clear trees without killing them, they were sprayed with oil transformed into fine drops by the apparatus. The insects appeared to be so paralysed that they fell from branch to branch, not without trying to get a hold, to the ground where they died. This the way in which the apparatus should not be used except where normal treatment is impracticable, as it consumes much oil and consequently is more burdensome.

The flame-thrower treatment requires about 700 litres of oil per hectare and costs from 300 to 400 francs. It seems at first very expensive, but the great speed makes it clearly better than all processes hitherto, used, and it acts best either on the laying places at hatching time or columns of insects when just forming, or again among bushes where the crickets collect before undergoing transformation.

Poison gases. — A mixture of carbon oxychloride and tin chloride was tried on the bottom of a ravine where the crickets were collected in large numbers. The insects on shrubs were not affected but the young ones on the ground were quickly killed.

This process, which makes use of a large amount of bulky material, involves risks not only to the operators but also to people or animals near by, as well as to vegetation. It could be employed only in the southern desert belts.

148 - **The Destruction of the Rice Weevil with Chloropicrin** (1). — BERTRAND, G., BROCQ-ROUSSEAU and DASSONVILLE, *in Comptes rendus des séances de l'Académie des Sciences*. Vol. CLXIX, No. 19 (Nov. 10 1919), pp. 880-882. Paris, 1919.

These investigations were made on the rice weevil (*Calandra oryzae* L.s.) which is very prevalent in maize grains.

The authors first examined the effect of poisonous vapour on the weevil outside the grain, using the same methods as in their researches on bed bugs (2) ; 560 specimens were utilised. The subjoined table shows the results arrived at in 4 series each including 14 experiments. The volume of the flask was of 8 litres, and the temperature between 20 and 27° C.

The authors tried to find by means of these results the conditions under which, in practice, the weevils contained in grain could be destroyed. One hectolitre of infested maize which they used had an apparent density of 0.715 and included 62 litres of actual grain and 38 of interstitial air. If it had been necessary, in order to kill the weevils, only to vaporise the proportions of chloropicrin indicated in the annexed table, a few grammes of this substance per hectolitre would have been sufficient. The insect, however, is sheltered inside the grain and the latter holds, at least for a time, a small proportion of the poison vapour. Hence it is necessary, as the experiments demonstrate, to use more chloropicrin in order to kill the weevils contained inside the grain than to kill those outside.

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(1) See *R.*, July-Sept. 1919, No 1050 (*Ed.*)

(2) See No. 6 in this *Review* (*Ed.*)

Time required to kill specimens of the insect with chloropicrin.

		No. of grammes of chloropicrin per cubic metre.						
		1 h m	2 h m	3 h m	4 h m	5 h m	6 h m	7 h m
Series	1	15.45	8.0	6.30	5.15	4.30	3.40	3.15
»	2	15.45	7.30	6.30	5.0	4.30	3.30	3.15
»	3	15.0	7.20	6.10	5.0	4.10	3.20	3.10
»	4	15.0	7.0	5.45	4.30	3.45	3.10	3.40
Average time		15.25	7.30	6.14	4.56	4.13	3.25	3.5
		8 h m	9 h m	10 h m	15 h m	20 h m	25 h m	30 h m
Series	1	3.10	2.35	2.35	1.25	1.15	1.0	0.45
»	2	2.45	2.25	2.10	1.20	1.10	0.55	0.45
»	3	2.45	2.20	2.10	1.20	1.10	0.55	0.40
»	4	2.30	2.15	2.0	1.10	1.0	0.45	0.40
Average time		2.48	2.24	2.14	1.19	1.9	0.54	0.53

By varying the conditions of experiment, the authors saw that the quantities required vary appreciably according to circumstances, such as: depth of the layer of grain, duration of contact with chloropicrin vapour, temperature, etc.

Direct treatment of the grain in bags, which is at once the most practical and difficult method, was successfully carried out in consequence of the authors' experiments: by pouring from 20 to 25 gm. of chloropicrin on to each bag lying on the ground in a closed chamber, twenty hours were long enough to ensure the death of all weevils, at a constant temperature of 10-12° C. The insects killed were almost all outside the grain; they may easily be got rid of by winnowing, and the grain may be fed to stock.

This method being very simple and effective ensures at once and at the same time the destruction of the insects which manage to get out of the grain and hide in cracks of the wall or floors in the chamber where the treatment is carried out.

149 – ***Ampera intrusa*, n. gen. and n. sp., a Rhynchote Discovered among Rice Grain in Store, in Java.** — DISTANT, W. L., in *Bulletin of Entomological Research*. Vol. X, Part. I, p. 41, 1 fig. London, Nov., 1919.

INSECTS, ETC. INJURIOUS TO VARIOUS CROPS

Under the name *Impera intrusa*, a (family *Lygaeidae*), discovered by Dr. C. J. J. VAN HALL in Java among rice in a warehouse, is here described as representing a new genus and species.

150 – ***Phthorimaea operculella*, a Microlepidopteron Injurious to Potatoes in Sicily, Italy** (1). — BORZÌ, A., in *Bollettino di Studi ed informazioni del R. Giardino coloniale di Palermo*. Vol. V, No. 1-2, pp. 35-38. Palermo, 1919.

Recently the presence of *Pythorimaea operculella* Zell. was reported in potato tubers grown near Palermo.

A description of the insect is given, accompanied by biological notes and an indication of the most effective means of control.

151 – **The Chief Insects Injurous to Sugar Cane in Fiji.** — VEITCH, R., in *Bulletin of Entomological Research*, Vol. X, Part 1, pp. 21-39. 8 figs. London, Nov., 1919.

While awaiting the publication of the final results of his investigations begun in 1914 on the insects causing serious damage to sugar cane in the Fiji Islands, the author enumerates the more important species observed chiefly in the districts of Lautoka, Rarawai, Nausori (Viti Levu) and Labasa (Vanua Levu). He also gives biological notes on each of these insects and indicates the control measures adopted. The chief varieties of cane grown in the zone where the investigations were carried out are Badila, Malabar and Pompey.

The insects injurious to cane which were examined are :—

Rhabdocnemis obscura Boisd. (cane beetle borer) ; *Trochorrhopalus strangulatus* Gyl. (small cane beetle borer) ; *Rhopaea vestita* Arrow (white grub of sandy soils) ; *R. subnitida* Arrow (white grub of alluvial and red hill soils) ; *Adoretus versutus* Har. (rose beetle) ; *Simodactylus cinnamomeus* Boisd (sugar cane wireworm) ; *Lacon stricticollis* Fairm. (yellow wireworm) ; *Cirphis unipuncta* Hawd. (sugar cane army-worm) ; *C. loreyi* Dup. (sugar cane army-worm) ; *Trachycentra chlorogramma* Meyr. (moth borer of cane); *Cosmopteryx* n. sp. (cane leaf-miner) ; *Perkinsiella vitiensis* Kirk (leaf hopper) ; *Aleuroides comata* Mark. (cane aleurodid) ; *Pseudococcus bromeliae* Bouché (cane mealy bug) ; *Locusta danica* L., *Cyrtacanthacris guttulosa* Walk.

152 – **Insect Pests of Tobacco, in India.** — See No. 54 in this *Review*.

153 – **The Coleopteron *Lasioderma serricorne* and the Lepidopteron *Setomorpha margalaestriata* Injurious to Stored Tobacco, in Sumatra** (1). — See No. 130 in this *Review*.

154 – **The Earwig (*Forficula auricularia*) as a Pest on Pear-tree Leaves, in Switzerland.** — STAUB, W., in *Schweizerische Obst und Gartenbau-Zeitung*, No. 20, pp. 313-314. 2 Figs. Mœsingen, Oct. 15, 1919.

This orthopteron, which is very common and well known as an eater of many kinds of food — it feeds on animal and vegetable matter — has recently been recognised as capable of causing serious damage to the leaves of the pear tree.

At the beginning of June, 1919, a very young wall pear-tree growing on a wooden partition in a garden near Berne appeared, even from a distance, to have its foliage severely injured by insect attack. One part had only the skeletons and ribs of its leaves remaining, and many of the other leaves were more or less riddled with holes and nibbled round their edges.

Examination of the leaves and branches during the daytime showed no trace of the agent causing the damage, but at night an inspection of the young tree revealed a large number of larvae of *Forficula auricularia* L. busy at their work of destruction. Also on the wooden wall and on the metal wires used to support the branches many larvae were found which were trying to get on to the leaves.

(1) Cf. *R.*, Dec. 1918, No 1436, (*Ed.*)

A score of specimens captured on the leaves and put in a vessel were fed with still intact fresh leaves, plucked from the tree in question. The insects produced on these leaves the same kind of damage as described above on the leaves in the open.

Careful search and destruction of the insects carried on for two consecutive days was sufficient to preserve the foliage from further damage. In addition, a period of showery weather which happened at this time helped to clear away the insect.

155 – ***Stenolechia gemmella*, a Microlepidopteron injurious to Oaks in Switzerland.** — BARBEY, A., in *Journal Forestier Suisse*, Year LXX, Nos. 9-10, pp. 129-131. 1 Pl. Berne, Sept.-Oct., 1919.

Stenolechia gemmella L. (*Poecilia nivea* Han.). the appearance of which had previously been reported in Switzerland, spread during 1919 from one end to the other of the country on *Quercus Robur* L. var. *pedunculata* (Ehrh) and var. *sessiflora* (Salisb.)

As a result of attack by this partasie the oak branches thickened for a length of 2 to 6 cm. at their ends. A longitudinal cut on one of these branches showed in the interior the small caterpillar of the insect boring an irregular tunnel having more or less pronounced strictures.

On the basis of observations made so far, the author has come to the conclusion that the insect produces only one generation a year.

If a certain proportion of terminal buds dry up, there will obviously be a considerable loss in growth.

Possibly the invasion of *S. gemmella* may still continue in 1920, perhaps over a wider area, but it is to be expected that a year or two hence this insect will disappear ander the influence of adverse natural causes.

156 ***Lithocolletis platani*, Microlepidopteron injurious to Planes in France.** — *Bulletin de la Société entomologique de France*, No. 15, pag. 262. Paris, 1919.

M. P. VAYSSIÈRE states that the leaves of planes at Fontainebleau and neighbourhood, were attacked by the mining caterpillar of *Lithocolletis platani*, a microlepidopteron considered as indigenous further south. Some of the leaves examined showed signs not only of mines containing the young caterpillars but also of empty pupa cases ; this fact suggest the existence of a summer generation of the parasite.

[154-156]

ALFREDO RUGGERI, gerente responsabile.

In quoting articles, please mention this REVIEW.

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The Editor's notes are marked (*Ed.*).

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART

ORIGINAL ARTICLES

The Rearing of Donkeys and their Crosses with Horses in Italy and her Colonies.

By Professor ETTORE MASCHERONI

Lecturer in Animal Husbandry at the Royal Higher School of Veterinary Medicine of Turin.

DONKEYS.

ITALY. — Donkeys appear to have been first imported into Italy by the Illyrian tribes, and perhaps even before then by the Cumans at the period of the foundation of Cuma in the island of Ischia. The rearing of donkeys is not uniformly distributed over the country, as it is seldom carried on in the north, but more extensively in the centre and still more in the south of the peninsula and in the islands of Sicily, Pantelleria and Sardinia.

In 1918, Italy had 949 162 donkeys and in this respect ranked immediately after Spain. The distribution was as follows: —

Piedmont	15 922 head	Abruzzi and Molise	86 283 head
Liguria	10 305 »	Campania	133 039 »
Lombardy	44 268 »	Apulia	55 283 »
Venetia	38 666 »	Basilicata	34 226 »
Emilia	35 595 »	Calabria	79 164 »
Tuscany	59 169 »	Sicily and Pantelleria	205 099 »
Marches	16 041 »	Sardinia	37 601 »
Umbria	36 088 »	In the army	4 565 »
Rome (Latium)	57 398 »		

The donkeys in Italy are of the following breeds: — *Apulian, Sicilian, Pantelleria* and *Sardinian*. Only the first three are used for mule breeding.

The Apulian donkeys include the sub-breeds of *Lecce* or *Martina Franca*, of the *Marches*, of *Romagna*, of *Basilicata* and of *Calabria*. The Sicilian includes two sub-races, that of the *eastern provinces of the island* (chiefly Syracuse, and next Catania) and that of the *western provinces* (chiefly Trapani, Palermo and the littoral of the provinces of Girgenti and Caltanisetta) (Tucci).

The *Apulian* breed is tall, with a long, well-proportioned body. The height may be of 1.45 metres or over. The head is large; eyes rather small; ears long, wide, hairy and lying nearly horizontally; mouth not very big; nostrils not very open; jaws large and throat region narrow. The neck is large at its base and well fixed to the head; the back straight; hind quarters well made; limbs robust; joints very visible; hoofs fairly big; coat generally dark but sometimes grey. Hair smooth, seldom curly; hair of the tail abundant; hair on fetlock and coronet of some length but shorter than in the Poitou type.

" These points are common to the four breeds named, but are in greatest harmony in the *Martina Franca* breed, which is also the largest; they vary a little in donkeys of the Marches, Basilicata, and Calabria, and are less in harmony in the Romagna breed " (Tucci).

The *Pantelleria* type is of great importance for cross breeding in Italy The island of Pantelleria (the ancient Cossyra), situated midway between the Sicilian and African coasts, has always been famed for its donkeys which, although of purely African origin, have a faint resemblance in general appearance and in colour of the coat to the so-called European donkey.

Tucci, who has specially studied the donkeys of this island, states that the grey coat has almost disappeared from among them, as the preference is all for a black coat with white muzzle and white or grey hair under the belly and on the inner side of the thighs. " The stripes of dark hair on shoulders and withers have also disappeared naturally, in consequence of choosing breeding animals with a uniform coat, preferably dark bay or quite black. The Pantelleria breed has also other special points: — Quick gait and sure-footedness on steep slopes, over pebbles and stones of all shapes and sizes; a natural tendency to an ambling pace which gives the animal a greater market value and makes it one of the best for riding on; quick growth, so that yearlings are already excellent beasts of burden; endurance on long journeys with a load of 3 to 4 cwt. on its back. The hardiness of these animals is exemplary and their sobriety extraordinary. They eat anything, and at vintage time some of the refuse unsaleable grapes are kept for them. With this food and at this season, if the owners of the animals have means to treat them better, the animals show the effects of more liberal diet and grow fat, while the coat becomes very bright and their energy and spirit become even more evident. The temperament of the Pantelleria donkey is "nervous-sanguine", though it comes under the class of large-sized animals, which is not common in donkeys of the other parts of Italy and abroad, intended for mule breeding.

" These animals are agile and lithe in form; the legs are slender, muscular and dry. By " slender " I do not mean they lack proportion as a whole,

as this point is a distinctive feature about the animal and indicates neither weakness nor deficient development of the bony foundations of the limbs. The back is almost always straight; the croup is often well shaped, especially in the female ; the fore quarters are well made : the head is light ; the ears are relatively short, very mobile and always borne straight ; the foot is big, admirably shaped, and the hoofs are so hard that they do not need shoeing. The hair is always short and smooth, seldom curly. The height varies from 1.28 to 1.40 metres ". (Tucci).

Unfortunately this excellent breed is small in numbers, amounting to barely a thousand head.

The *Sizilian* donkey has points which separate it from the Apulian, but which do not attain the elegance and perfection of the Pantelleria breed. Whereas the type from the eastern districts is more like the Apulian, that from the western and southern parts has rather more resemblanee to the Pantelleria type.

The height on the average is 1.35 metres, with chest measurement of 1.65 m. and girth of front legs 0.175 m. ; the coat is grey ; head well proportioned and with slightly rounded profile ; ears long and straight ; neck large ; back straight ; hind quarters somewhat sloping ; tail with fairly long hair ; limbs strong and hoofs well shaped.

The *Sardinian* donkey is very small (0.80 to 1 m.), with brown or dark coat, rarely light and with the cross mark ; head too heavy for size ; ears long and straight ; neck and shoulders weak ; mane scanty and darker than coat ; chest sufficiently developed (from 1.10 to 1.20 m. round) ; back straight and robust ; limbs well formed, sturdy and furnished with excellent hoofs ; tail long, with little hair.

It is used as a beast of burden and often as a draught animal, but it is also used to turn mill-stones, hence the name " *molentes* " given to these animals by the Sardinians.

The feed consists of straw, beans, barley and hay when there is any. When not at work the animals are sent to grass, and a single herdsman looks after the donkeys of the district, collecting them by trumpet call (Galbusera).

The chief rearing districts in the province of Sassari are Padra, Pozzomaggiore, Alà dei Sardi, Marca Romana, Villanova, Monteleone and, in the province of Cagliari, Campidano di Oristano and Iglesiense (Faelli).

For this animal no fairs, markets or exhibitions at all are held.

Colonies.— *Libia.* — The donkeys of Libya are of small stature, mostly brown coated, almost white at the muzzle and belly, and round the eyes.

Of the donkeys of Tripoli, Pucci and Gugnoni say : " Their chief distinguishing points are their lack of height (95 cm. on the average) and their extraordinary thriftiness.

They are well proportioned and clearly distinguishable from the small, thick-set Sardinian animals ; in form they resemble most the Abyssinian breed. Inland the donkeys have a grey coat with the mule stripe more frequently than those at the coast perhaps, but the predominating colour is always brown, more or less dark, with typical light areas on the belly,

on the inner part of the thigh and round the eyes and mouth. Ther are also, however, completely black specimens. The incision made b the Arabs in the nostrils of these poor beasts, with the idea of thus facilita ting breathing, is less common we think, in the interior than at Tripoli Another very strange operation is that of piercing the tips of the ears o young donkeys and tying the tips close together to improve their appearance

" Not only in the streets of Tripoli but also in the Djebel other breed are met with, but which are of greater height, proving that the importatio of individuals of other breeds must have been made for a long time and t some extent. At Djebel Garian and at Djebel Ferrigna we measure some of these, and their height was over 130 cm. at the withers. Th natives state that the crosses between the small local breed and the im ported donkeys are highly valued, as these have the thrift and enduranc of the small African types, and also the advantage of greater size and conse quently greater strength. Old Arabs at Garian assured us that the introduc tion of other breeds of donkeys into their country and the presence of cros ses are not events of recent date but go back to the middle of the 19t century at least. Further in the interior, for example, the tribes of Orfell and Oulad Bouchef possess only small donkeys.

Erithrea. — MARCHI say that the *Erithrea* donkeys have analogies wit the *Abyssinian* and *Nubian* breeds, including the *Etbai* types, and he add — " The Abyssinian breed includes almost all the donkeys in the Colony It lives on the plateau, the low plain on the east, the Sahel, the weste slopes of the plateau and is also distributed over the Gasc residence an Setit and Barca. There are also, it is true, many Etba and Kassala speci mens, but they are few in comparison with the first.

" The *Abyssinian* is of slate-grey colour, seldom brown. It has th mule stripe and the cross mark, and fairly often zebra stripes to the kne or hock. During the " keremly " (rainy season) the hair becomes long and o a more definite grey, which turns to rust colour during the " hagai " (dries season), when it thins and falls out. The muzzle, inner part of thighs, belly and parts round the eyes are white. Here and there in the Colony, but no often, grey specimens spotted with white are to be seen. Those of brow colour, of the same type as our European ones, do not differ from the grey in the other outward characteristics.

" Their height is about 97 cm., the oblique length of the trunk fro 107 to 110 cm., the chest circumference from 113 to 115 cm.; the head i heavy, the face convex ; the ears are shorter than in the European type, an the mane is short.

" I consider that these animals surpass in sobriety our European types which are proverbial. During the " hagai " they may be seen grazin around the villages on the scanty and short dry grass, which they crop clos in a marvellous way, and which would be quite insufficient food for suc thrifty beasts if they could not supplement it with " ari ".

" The *Kassala* breed resembles the wild Nubian type just as the Abys sinian breed resembles the wild Somali. The Kassala is reddish-grey, mor or less bright and more or less light, which shades off to white on the belly

the inner part of the thighs and the fore legs, the muzzle, and the parts round the eyes ; the back stripe is black, in the form of a cross ; seldom zebra striped on the legs. The type is clearly long-bodied. The height is about 112 cm., the length of the trunk 116 cm. and chest circumference 125 cm.

" The *Etbai* differs from the Kassala breed in its lower stature (100-102 cm.), its diametral shape more similar to that of the Abyssinian breed, from which it is chiefly distinguished by its reddish grey colour and by its shorter and finer hair. White-spotted specimens are found also among the Etbais, but they are rare ".

Somalidand. — The *Somali* donkey, with its two forms, one large and lithe, the other small but not thick set, is a variety of the Abyssinian breed. It is found all over Italian Somaliland, especially between the coast and the rivers.

PROVENZALE describes it thus: —" Its chief points are: — Average height 1.14 m. in large animals, and 1.08 m. in small ; length 1.20 m. in the former and 1.16 in the latter ; average chest diameter 1.28 m. in large and 1.24 m. in small animals. Head heavy, with slightly convex outline ; ears not very long, often cut ; neck massive ; mane short ; barrel long ; members extraordinarily robust, especially the legs... ; coat bright grey during the rainy season and almost reddish, as if tanned, during the dry season. Some specimens occasionally have dark hair with a tendency to brown. Often the colour is paler round the eyes and lips, on the belly and inner part of the thighs. The dorsal line and cross are seldom absent, while zebra-markings, very apparent when they are present, are less common. It is mostly on the coast that specimens are found with light-coloured coats ; this type may easily be descended from the classic Egyptian ass, imported from the opposite Arab shore where it is much used as a saddle animal, especially at Aden.

" The small Somali donkey is a very thrifty animal,which can make the most of the slightest traces of vegetation, so that it is scarcely ever seen in a thin condition during good seasons it is fat and rounded. These small animals carry loads that would seem unbelievable: from 50 to 80 kg., for long and repeated journeys ; but they go at a lazy gait when loaded. The Somalis scarcely ever use them as saddle animals...".

This animal seems to have a fair degree of resistance to trypanosomiasis and might very advantageously be used in Somaliland for breeding mules, or better still jennets.

MULES AND HINNIES

ITALY. — Coming originally to Italy from Greece, the mule at the present time plays a very important part in this country.

In number of mules (496 743 in 1918), Italy comes second to Spain among all European countries. She uses the mule to a large extent as a beast of burden, for draught purposes and for agricultural work. If mule breeding there has developed so greatly without special help, it is because it is more

suitable economically and is of greater practical value, as compared with horse breeding, for local conditions.

Of all the parts of Italy, the richest in mules is Sicily, followed in numerical importance by the southern Adriatic district, the southern Mediterranean district, Piedmont, Latium, Lombardy, Tuscany, Liguria, Venetia, Emilia, the Marches, Umbria, and lastly Sardinia. The real mule breeding, however, is carried on only in Sicily, the Marches, Umbria, the province of Aquila, in Apulia and Calabria ; elsewhere it is carried on to a very limited extent and only mules bought in the breeding centres or abroad when young or already full grown are reared.

Breeding of hinnies (progeny from crossing a stallion with a female ass) is seldom practised, and is to be found in Apulia, Sicily and some other places, but to such a small extent that it is confounded with mule breeding.

Piedmont and Liguria. — The mule population of these two regions is largely of Savoy and Poitou origin, but whereas in Liguria (18 692 head) hybrids are purchased when ready for service, in Piedmont mules of 6 to 10 months old are imported on a large scale and then reared and broken in.

In Piedmont (18 447 head), breeding is seldom if ever carried on, whereas it ought to be encouraged there more than anywhere. The western part especially, on account of its geographical position and its climate, is very well adapted to this kind of breeding. NAPOLEON I saw that this part of Italy fulfilled all the necessary conditions for the purpose, and, in fact, at the beginning of the 19th century, some donkeys were reared as stallions at the " Venaria Reale " near Turin.

The stud book of the imperial breed of horses of the " Mandria di Venaria Reale " (a register which runs from 1806 to 1814) states that there were reared in this district, along with 50 stallion horses, 7 stallion donkeys foaled between 1802 and 1809; these were named *Balotino, Bergamino, Fogoso, Rodomonte, Speranza, Vittorioso and Midas.* They were used as sires till 1814, in which year, after the Russian disaster, all of them except *Speranza* were sent to France, according to the statement written at the foot of the pages containing the pedigree of each stallion : " Je soussigné, inspecteur du haras, certifie que, par ordre de M. le Préfet, en date du 1er mai 1814, j'ai emmené en France le baudet ci-dessus signalé ".

Lombardy. — Almost all the mules reared in this part (10 551 head) are imported from other provinces of Italy or from abroad (especially France and Switzerland). In Lower Lombardy, mules are not bred at all; it is only in the mountainous part, especially the provinces of Sondrio and Bergamo, that there are any production centres, but breeding is always done on a very limited scale, and with the poorest grade of mares, so that the mules raised there are small and thick set.

On the other hand, the Brescian type is of greater height, and in build resembles the Poitevin ; it is found mostly in the Orzinuovi district and is obtained by crossing with the Pantelleria donkey.

" It has for long been known that many Lombardy mares may be *a priori* adapted to mule breeding, but the main want is the lack of a good

breed of donkey. This is the reason for preference being given to horse rearing and the few people who find it necessary to keep mules import them from Switzerland or from other parts of Italy " (Tucci).

Venetia. — Mule breeding is generally of negligible importance there (6 181 head). Only in the provinces of Vicenza, Paduva (Camposampiero, Este, Cittadella, Montagnana) and Treviso (Oderzo) is there in operation any great number of breeding stations for asses, with stallions imported from Romagna, the province of Brescia and even from Pantelleria.

There are in Venetia 2 varieties of mules, differing only in size : — one very small, at most 1.20 metres high, and the other bigger, well made and very strong (Tucci).

Emilia. — There is practically no rearing in the provinces of Bologna and Ferrara or in Romagna, and the few mules found there are imported from other parts of Italy. On the other hand the mule industry is of greater value in the Apennine district of Emilia, especially in the Bardi, Castel San Giovanni, Fiorenzuola, Borgotaro, Finale and Mirandola territories. The mules breed there from native donkeys (with defects) from Romagna, the Marches or Umbria, are not of great size, but to good shape they add strength and endurance in work. In 1918, the number of mules in Emilia was 5 267.

The Marches and Umbria. — The mules of the Marches and Umbria (7 677 head) have the same outward lines and the same disposition. Of medium height (1.35-1.45 m.) they are well proportioned animals ; the neck is short, the body thick set; the limbs are long, strong, vigorous, with large joints, good tendons and excellent feet ; the coat is nearly always bay. They are excellent beasts of burden and very well suited for heavy and quick draught purposes.

In these parts the mule breeding industry is prosperous and the export of young mules very important.

The stallion donkeys used there as sires are not good types ; most of them lack necessary qualities, and, according to Tucci, asses imported from the province of Lecce would help and improve this important branch of animal production, which exists and thrives admirably without assistance because it is based on a first class economic principle, that of profit.

Ancona, Pesaro, Ascoli Piceno, Macerata and Perugia are the provinces that produce most of the mules of the Marches and Umbria.

There are important mule fairs at Loreto (September 23) and Assisi (October 25).

Tuscany. — Mule breeding (6 072 head) here is not widespread, and numerous donkey stud stations exist only in the mountainous parts of the provinces of Pisa, Massa, Arezzo, Siena and Florence. Tuscan mules, which are the result of crossing native mares with native asses of small size and poor development, are not of great size, but are strong and have good staying qualities for work, and are excellent for weight carrying and hauling. The export of these animals every year, chiefly to Liguria and Lombardy, is of some importance.

Latium. — Mule breeding is little practised in this region, where there

where 16 053 animals in 1918. It is difficult here to substitute mules for horses, which still find good buyers and which can be raised here easily and at little cost. Generally the animal shows the influence of the sire, which is very small. Mules of some size are also to be seen, which are active and fatigue-resisting, good trotters, dark bay or black in colour, but they are not very numerous and are the progeny of donkeys of the Marches or of the south, crossed with Roman mares.

South Adriatic Region (Chieti, Aquila, Bari, Lecce, Foggia and Campobasso). — Breeding plays a very important part here (6490 head in 1918), as the sale of the mules is prompt and easy. Campobasso, Lecce and Bari are the provinces where the industry is most widespread, but it is also considerable in the province of Foggia and in the Abruzzi. Bertetti, quoted by Faelli, states that the province of Aquila is one of the most important mule-breeding centres. " The real centre for this production lies in the small district of Montereale, not far from Aquila,as hundreds of mules are brought to its fairs and sold when a few months old. They are bought by large owners (" latifondisti ") who carry on the rearing of herds and who use mule transport for all the material required in their business ".

The mule of this part is very high. (from 1.34 to 1.50 m.), thick set, long headed, with long ears and small eyes ; croup wide and not sloping off much ; chest wide and deep ; limbs rather slight but with good joints and strong tendons. The colour is bay, brown or grey. Mules are raised here on open pasture which does not favour the full possible growth, as forage is scarce. In Apulia the hinny is occasionally met with.

South Mediterranean Region (Naples, Avellino, Benevento, Caserta, Salerno, Potenza, Cosenza, Catanzaro, Reggio Calabria). — The provinces of Reggio, Catanzaro, Potenza and Benevento are those which breed most mules; in the rest of this region these animals are generally imported. In 1918 the number of mules in the south Mediterranean region was 36 283.

Calabria supplies the best animals. Tucci describes them thus : — " Head generally rather big ; forehead wide and square; ears not very long ; eye large and lively ; nose large with well-opened nostrils ; mouth not very narrow ; neck arched and well set on to head, pyramidal in shape and with wide base on the trunk ; barrel cylindrical ; chest wide and deep ; ribs well sprung ; hocks high ; line of back and loins slightly convex ; back thinning off towards withers and widening gradually to the loins ; croup ample and not sloping much ; tail well attached ; abdomen not very bulky ; limbs straight, strong and vigorous, spare but not too slim. These animals can be used for comparatively speedy work and do very well when yoked to light carts. Their coat is dark bay, rarely chestnut coloured, and often black. As grey mules are less desirable, they are much more seldom to be seen. The height varies from 1.50 to 1.60 m. " The mules from this region are in great demand by military remount commissions.

The mules of Basilicata and the province of Benevento, though smaller, greatly resemble the Calabrian animals.

Many hinnies are bred also in the provinces of Cosenza, Caserta, Avellino and Benevento.

Sardinia. — Mule breeding is practically non-existent here (366 in 1918), although the place is quite suitable. It should be remembered that in Sardinia there was, and perhaps still is prevalent, the prejudice that mules spoil the horse. Attempts at crossing, made by the Ministry of Agriculture, which had Pantelleria donkeys sent to this island, so far do not seem to have given the results expected.

Sicily. — This is the part of Italy where mule breeding is engaged in to the greatest extent ; in 1918 it contained 27 799 mules.

" Sicily has never belied the reputation it has gained for possessing a large number of mules of excellent constitution, thanks to the good breed of asses and of mares in the country. These have inherited from their genitors the quantity of blood necessary for making excellent mules which, if they have imperfections in external form inherited from their dams, are nevertheless not to be despised, as it is not elegance and beauty which are expected in the mule but strength and endurance for work. The mule is much sought after in Sicily and the mule industry there grows more and more important; and now, especially when railways are opening up the country, the amount of fast work demanded of the horse, whose pace is more rapid than that of the mule, is falling off, and the latter animal, though less suited for quick going is stronger, more enduring and better able to bear the long fatigue, especially the hard country work, and cannot be replaced by other animals.

" In order to estimate the number and the demand for mules, the condition of our means of communication should be recalled, particularly in the interior of the provinces,whereby animal transport is of more importance than wheel transport. The demand for mules is so great that when there is a shortage of these in the provinces, large numbers are bought from other parts, principally Calabria ". (DEMARCHI).

The Sicilian mule (Report of the census of the province of Catania, quoted by DEMARCHI) has a mean height of 1.45 m., with head fine, light, of rectilinear outline, rarely with curves ; ears long ; neck muscular and pyramidal in form ; withers outstanding ; breast wide ; chest round ; back generally straight ; croup often very sloping, sometimes round and arched, but more frequently short and narrow than long and wide ; belly large ; extremities provided with rigid tendons, solid joints and very hard hoofs ; hide generally fine and covered with short bright hair. The coat of the Sicilian mule is generally bay in all its shades, black,grey, but seldom brown. The cross and zebra markings are often found in the lightest coloured coats. White feet occur very rarely.

Some specimens are as much as 1.50 to 1.52 m. in height, but many are under 1.40 m.

Mules are used for work of all sorts : at the plough and as beasts of burden for transport of agricultural products and sometimes of building material. They are used also in light cars, which they draw at the trot ; fairly often they serve as saddle animals, their pace being very convenient as they have an ambling gait (BIZZI, quoted by DEMARCHI).

Of the 7 provinces in the island, the most important in the mule business are those of Palermo, Girgenti, and Caltanisetta.

There are also many hinnies in Sicily ; these are very small but of extraordinary strength and endurance for their size. (CHIARI).

COLONIES. — *Tripoli.* — Mule breeding here is of slight extent and in the interior almost unknown. " To all questions asked by us on the subject, the answer was that only some few specimens could be recalled, and these were obtained more by chance than by design. The breeding of mules from imported asses could give, as in Eritrea, excellent results, but the small number of mares at present in Tripoli would allow only very limited growth in this line ". (PUCCI & GUGNONI).

Erithrea. — The mule of Erithrea and of the whole of Abyssinia stands 1.20 to 1.40 m. high. Docile and very resistant to work and to climatic changes, it is excellent for the saddle. The head is not very light, but is short and somewhat pyramidal ; forehead broad and flat ; ears not very long ; eye large and very spirited ; nostrils large ; neck arched, with a mane ; back straight ; loins short and solid ; croup well made ; breast wide, chest full ; legs rather slim, dry, with strong joints ; feet very solid, not requiring shoeing ; colour varied.

From the reserarches of MARCHI it appears that hinnies are not to be found either in Erithrea or beyond the Mareb.

Somaliland. — North Somaliland produces no mules, and in the southern part these animals come from the Ethiopian plateau through Lugh or or Eritrea.

" Attempts at mule breeding would be worth while on the Benadir coast. While under no illusion as to the success of the enterprise, for mule raising is not always an easy matter, it would be advisable to make the attempt, in view of the importance of rearing for service animals, the importation of which from Abyssinia is becoming ever more difficult and expensive. The attempt should be made by using the best stallion asses of the country and the mares of the neighbouring plateau, or better still of North Somaliland and Agaden. The progeny would evidently be of small size but would possess vigour and endurance. (PROVENZALE).

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SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

157 – **The Nutritive Value of the Wheat Kernel and its Milling Products.** — OSBORNE, T. B., and MENDEL, L. B. with the cooperation of FERRY, E. L. and WAKEMAN, A. J., in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 4, pp. 557-601, 14 diagr. Baltimore, April, 1919. RURAL HYGIENE

The authors undertook a detailed study of the composition and nutritive value of the wheat seed and its milling products, from the particular point of view of the problems arising from modern milling methods and the yield desired of the latter for general use. They review the literature on the composition of the embryo, the outer seed coats or bran, the endosperm and the whole seed, and they give the data extracted from this literature or obtained from their own investigations. The chief points are summarised in the appended tables.

TABLE I. — *Proportion of nitrogen in the various parts of the wheat kernel.*

	Part as per cent. of seed	Per cent. of seed as nitrogen in part	Per cent. of seed as protein in part (N × 5.7)	Per cent. of protein in part	Per cent. of total protein of seed in part
Endosperm	83.5 %	1.61 %	9.17 %	11.1 %	73.3 %
Bran	15.0	0.49	2.80	18.7	22.3
Embryo	1.5	0.10	0.57	36.7	4.4
	100.0	**2.20**	**12.54**	—	**100.0**

TABLE II. — *Percentage composition of dry matter in the wheat kernel.*

	Whole wheat	Endosperm	Bran	Embryo
Saccharose	0.61 %	0.24 %	1.92 %	24.34 %
Dextrin, etc.	2.01	3.63	5.03	
Starch	63.80	77.52	0.00	0.00
Pentosans, etc.	6.27	1.80	32.77	?
Crude protein (N × 6.25)	11.25	11.17	17.60	40.25
Fibre	1.75	0.34	11.18	1.71
Fat	2.18	1.15	8.26	13.51
Ash	2.03	0.43	8.61	4.82
Undetermined	10.10	3.72	14.63	15.37

TABLE III. — *Percentage composition of commercial wheat germ meal.*

Sugars	7.71 %
Dextrin	7.50
Starch	18.21
Pentosans, etc.	8.29
Protein (N × 6.25)	31.00
Fibre	2.35
Fat	10.44
Ash	4.91
Undetermined	9.59

For the most part, the experimental work of the authors consisted in a long series of experiments on rats, to reach a quantitative comparison between the entire wheat kernel and its milling products with respect to the nutritive value of their proteins and their content of water-soluble vitamine, both for the maintenance of adult rats and the growth of young ones. The results of these investigations may be summarised as follows : —

The proteins of the wheat kernel are not greatly inferior, for maintenance to casein or even to the total proteins of milk, but are somewhat superior to gliadin. They are adequate for promoting the growth of rats to normal adult size, but the quantity of protein required for growth is relatively large. The crude protein of commercial wheat embryo flour appears to be more efficient than that of the entire wheat kernel for maintenance, and much more efficient for growth. The crude protein of wheat embryo has a higher value for growing animals than that of the embryo, and is as efficient as that of the combination of wheat flour with egg, milk or meat. Hence the agriculturist is justified in his high estimate of the value of wheat bran as a protein concentrate.

The protein of the endosperm was adequate for the maintenance of adults but not for growth, even when the intake was large. A diet containing only 10.3 % of protein furnished by flour supplemented with egg, milk or meat

produced more rapid growth than a diet containing even 50 % more protein derived entirely from the wheat flour. This shows that, under ordinary human dietary conditions, the proteins of wheat are advantageously employed.

Commercial wheat embryo is much richer in water-soluble vitamine than commercial bran and flour. The pure embryo, carefully separated from all the other parts of the seed and used as the sole source of vitamine suffices to maintain young rats but fails to promote their growth. Wheat kernels from which the embryo has been carefully removed are still rich in water-soluble vitamine. Following on these observations the authors raise the question of whether the water-soluble vitamine is a single substance or a mixture of two or more. If it is a single substance il must be a constituent of the endosperm.

Rats fed for 1 year from the time of weaning on diets containing 92% of wheat or 50% of commercial wheat embryo reached full maturity without giving any evidence that wheat contains a toxic substance.

Applying these results to the question of the degree to which it is desirable to mill flour, the authors conclude that, except in special cases, little can be gained by including bran and embryo in the flour when this is used for human food under the conditions prevailing in the United States, where the greater part of the flour consumed is taken along with other foods which make good the nutritive deficiencies of its protein better than would be done by the proteins of embryo and of bran. Again, considering that the rations of farm animals require protein supplements and that wheat bran is a good source, the by-products of milling will be better utilised as food for animals than for man. Besides, as about 80 % of the wheat kernel can be so improved in nutritive value by adding animal products to the diet that a much smaller amount of flour will satisfy the protein need of nutrition, it may well be that the use of the by-products of milling for the production of meat, milk, or eggs will result in a greater economy in the use of flour than if these were used directly for human food.

158 – **The Slight Effect of the Malaria *Plasmodium*, on its Intermediate Host.** — See No. 222 in this *Review*.

159 – **Agricultural and Industrial Consultative Committeës in French West Africa.** AGRICULTURAL INSTITUTIONS
— *L'Afrique Française, Bulletin du Comité de l'Afrique Française et du Comité du Maroc*, Year XXIX, Nos. 11-12, pp. 341-342. Paris, Nov. & Dec., 1919.

A decree of May 21, 1919, instituted in the chief town of each of the colonies of Senegal, Upper Senegal and Niger, Upper Volta, French Guinea, the Ivory Coast and Dahomey a consultative committee for agriculture and industry, to represent at the local government the interests of the farmers, breeders, forest and industrial lists resident in the colony.

Since the beginning of the world war, French West Africa has managed to intensify its production considerably. In order to keep up and increase this effort the Governor of the colony created this organisation for bringing together the scattered authorities and coordinating their efforts.

The consultative councils in question are composed of two sections: the first of members elected on the ballot list system by the French colonists, and the second of native farmers nominated by the local authority. Their functions are exclusively consultative.

160 – **Sugar-making Schools in Canada.** — See No. 252 in this *Review*.

EXHIBITIONS AND TRIALS CONGRESSES

161 – **International Cold Storage Conference at Paris, December, 1919.** — *Communication from the International Institute of Cold Storage*, 9, Avenue Carnot, Paris, 17.

The International Cold-Storage Conference which met in Paris in December 1919 was held for the purpose of considering the creation of an international organisation which would enable every country to benefit in common from the work done by the scientists, economists and manufacturers of every nation, engaged in studying questions relating to cold-storage.

The exploration of the domain of low temperatures has been very productive in results of incalculable value for the whole of humanity during the last thirty years.

Thus, the cold storage of perishable foodstuffs now at the end of the war is the only means of saving from famine not only the French people but also most of the nations of Europe, as it has enabled them to have supplies of meat from the abundant livestock of such distant countries as South America, Australia, Canada, Madagascar, etc.

Furthermore, the exploitation of the inexhaustible resources of oxygen and nitrogen in the air has been undertaken for the first time by George CLAUDE. After giving rise to the industries connected with liquid air, the exploitation of temperatures of — 200° C will be capable in the near future, through the manufacture of artificial nitrates, of creating great sources of hitherto unsuspected wealth which will be available for the common good of humanity.

The Conference held its sittings on December 15, 16, and 17, 1919, in the Ministry of Commerce building. The general meetings took place under the presidency of M. NOULENS, Minister of Agriculture and Food, and the Commissions under the presidency of M. A. A. BERNHOFT, Minister for Denmark at Paris, assisted by M. T. DE ALVEAR, Minister of the Argentine Republic, M. Minozzi, Italian delegate, for the general administration Commission, and under the presidency of M. Ch. Ed. GUILLAUME (Switzerland), Director of the International Weights and Measures Bureau, for the second Commission which had special charge of the study of technical questions. Forty Governments, Dominions and Colonies were represented at this Conference by 89 delegates.

The Conference drew up an international Convention text which is to be submitted for ratification to all the Governments interested and which creates an International Cold Storage Institute, with its seat in Paris, in which all countries invited to enter the League of Nations under the conditions laid down by the Treaty of Versailles will take part. In view of the considerable interest taken, under present circumstances, in a rapid development of all applications of cold to the preservation of perishable food-

stuffs, the Conference immediately set up a general temporary Conference for the purpose of controlling and directing the new Institute. The latter has elected a provisional Executive Committee to secure its proper working, having as President M. André LEBON, late Minister, President of the French Cold Storage. Association ; Vice-Presidents M. T. DE ALVEAR (Argentina) Plenipotentiary Minister and Envoy Extraordinary for the Argentine Republic ; M. H. A. BERNHOFT, Plenipotentiary Minister of Denmark in Paris ; M. KAMERLINGH ONNES (Netherlands), Professor at the University of Leyden ; M. MENOZZI (Italy), Director of the Royal Higher School of Agriculture, Milan ; M. VESNITCH, Minister of the Kingdom of Servia.

The Executive Committe includes in addition 12 administrators, of various nationalities, and the Presidents of the various international commissions. The Presidents of the following international commissions were nominated immediately, so that they may begin their work as quickly as possible :

1st Commission : Scientific questions.

Section A : Physics, Chemistry, thermometry of low temperatures. President Prof. KAMERLINGH ONNES (Netherlands).

Section B : Units. President M. Ch. Ed. GUILLAUME (Switzerland).

Section C : Biology, Hygiene and Medicine. President, M. D'ARSONVAL (France).

2nd Commission : Cold Storage materials.

Section A : Cold Storage machines. President, M. Louis BLOCK (United States).

Section C : Methods of testing cold storage materials and plants. President, M. BARRIER (France).

3rd Commission : General applications of cold.

Section A : Perishable food and foodstuffs. President, Mr. J.'A. RUDDUCK (Canada).

Section B : Agricultural industries. President, M. MENOZZI (Italy).

Section C : Ice industries. President, Mr. D. A. BROWN (United States).

Section E : Liquid air industries. President M. G. CLAUDE (France).

4th Commission : Cold-storage trasport.

Section A : Overland. President, M. CATTANES (Italy).

Section B : Oversea. President Mr. MILTON (Great Britain).

6th Commission : Teaching and diffusion of knowledge. President, Mr. WEMYSS ANDERSON (Great Britain).

7th Commission : General economy and statistics. President, M. RAFFALOVITCH (Russia).

Since its first session the Executive Commission has elected to the post of Director of the new institution M. Emile GOUAULT, Secretary General of the French Cold Storage Association, late Naval Officer.

From the month of January, 1920, the Institute has arranged for the publication of a *Monthly Bulletin of Information on Cold Storage* issued in 2 languages, English and French, in which all the scientific, technical and economic documents of the whole world which have come to the

knowledge of the Institute are classified methodically. This publication aims at bringing quickly within easy reach of scientists and manufacturers, knowledge of the progress made in all parts of the world.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY

162 – **Organisation of the Agricultural Service of Applied Meteorology in Italy** (1) — Azzi, G., in *Bollettino della Unione delle Cattedre ambulanti di Agricoltura Italiane* Year I, No. 2, pp. 1-12. Rome, 1919.

Under the auspices of the Italian Farmers' Society, the author organised a network of agricultural stations of applied geography and meteorology which, since the sowing period in 1918, have begun a series of parallel observations on the growth of wheat and the incidence of meteorological factors.

The observations are recorded on 4 forms: —

1st *form*: from sowing till brairding.

2nd *form*: from brairding till restarting growth in spring.

3rd *form*: from restarting growth till flowering and setting.

4th *form*: from flowering and setting till maturation and harvest.

Each form consists of 2 parts or tables: Series A and Series B. In the table in Series A are recorded both the biological and the meteorological observations made by the observer objectively, without the use of instruments; while in Series B observations made by means of instruments on temperature, precipitation and sky are set down.

As an example, the 4th. form may be taken, which is as follows: —

Series A. (observations without instruments): —

1) Name of station . . . . . .

2) Name of variety of wheat . . . . . .

3) General condition of seedings at beginning of observations. . . .

4) State how and under what climatic conditions setting took place

5) Milk stage of ripeness (grain completely developed but still green and soft) — Date . . . . . .

6) Wax stage of ripeness (grain yellow and of the consistency of wax) — Date . . . . . .

7) Complete ripeness — Date . . . . . .

8) Before harvesting, choose an area of 1 sq. metre in the middle of the field, cut all the plants on it and count: —

a) the total number of plants

b) the number of plants having 1-2 stems

(1) In a previons work, the author showed the general lines of the fundamental ideas of his system, illustrating his article with complete detailed schedules and forms. The present paper gives a summary of the work done in Italy and reproduces one of the forms (the 4th) used in the agricultural meteorological stations.

The forms have had to be made as simple as possible, in order to encourage, at the beginning, the support and collaboration of the farmers, These helpers in time will improve and thus be able to extend their researches, as provided for in the general programme and in the complete form in the previous publication. (*Ed.*)

c) the number of plants having 1-4 stems
d) the number of plants having 4-5 stems
e) the number of plants having over 5 stems

9) When did harvesting begin and under what conditions was it carried out?

10) Climatic conditions and meteorological phenomena which, in the observer's opinion, favoured the growth and regular ripening of the grain .

11) Climatic conditions and meterological phenomena which, in the observer's opinion, damaged the growth and ripening of the grain . . . .

12) Diseases and insect pests . . . . . .

13) Growth of weeds and damage done . . . . . .

14) Average yield in kg. per hectare: straw . . grain. . . . .

15) Weight of 1 000 grains . . . . . .

16) Weight of 1 litre of grain . . . . . .

17) Other observations considered by the observer as useful to include.

SERIES B. (observations taken with instruments) : —

Date	Temperature in degrees C.			Rainfall in mm.	Clouds	Other observations (fogs, frosts, storms, etc.)
	Mean	Maximum	Minimum			

The elaboration of data collected after a sufficiently long period of observations will serve : — 1) to determine the crtitical periods ; 2) to determine the phenological means (for drawing up phenoscopic charts); 3) to determine for each decade of the growing period the mean frequency of the various meteorological phenomena ; 4) to determine the amount of damage due to each of the unfavourable meteorological phenomena.

The knowledge of the 4 above-mentioned data will allow of striking an exact bio-meteorological balance, by means of which it will be possible : —

1) to select from the different varieties of wheat the one best suited to a given district ;

2) to fix the best date for sowing and other operations so as to make the critical periods coincide with the most favourable times possible as regards the weather ;

3) to help the selector in his work of trying to combine in the best proportions the two qualities "specific productiveness,, and "resistance to the most harmful meteorological phenomenon,,.

In addition to the forms, a table of The Agricultural-Geographical Census for Wheat has been sent out to the stations, in which there are indicated

all the varcities of wheat grown in a given zone. For each variety the following information is supplied: —

1) Approximate area % of total area sown with wheat.

2) Average yield of grain per hectare on land of average fertility.

3) Morphological characteristics (if the wheat is awned or not, coloured or not).

4) Physiological qualities (early or late, etc.).

5) Land best suited for wheat-growing.

6) Land not suited for wheat-growing.

7) Adverse metorological phenomena to which the variety in question shows itself specially resistant.

8) Adverse meteorological phenomena from which the variety in question shows itself particularly liable to damage.

To this special information are added other general data regarding topographical and agro-geological conditions and the meteorological phenomenon or phenomena most injurious to wheat in the district concerned.

On the basis of the census data on wheat at several stations, a beginning will be made, during 1920, with a series of genealogical selections with the aim of isolating, from amongst local varieties, the pure lines which best adapt themselves to the climatic conditions of the place by uniting in the best proportions the two qualities of specific productiveness and resistance to the most unfavourable climatic factor, and hence giving the maximum yield of grain.

In the general work programme prepared in full detail for the 1st decennial period and the following one, an ever-extending collaboration with Breeding and Selection Institutions is provided for, so as to ensure that the results which will gradually be obtained may have the widest and most rational application.

163 - **The Climate of Illinois From an Agricultural Point of View.** — Mosier, J. G. in *University of Illinois Agricultural Experiment Station Bulletin* No. 208, pp. 1-125 + 14 fig. Urbana Illinois, Apr. 1918.,

Thetwo absolutely predominating factors for the growth of crops in the State of Illinois : are precipitation and temperature (and frosts)

Rainfall. — The total rainfall would be sufficient each year to produce maximum crops if the distribution was regular.

Distribution of rainfall. — The annual average for the State of Illinois is 37.98 inches, or more than 3 inches per month, an amount more than sufficient to insure an abundant harvest ; the fault is in the distribution of the rain : during the 10 years 1906-1915, at the University of Illinois, there have been 25 periods of 20 days or longer in each of which the rainfall has been less than 1 inch ; 6 of these periods lasted 20 days or longer. If the deficit periods coincide with one of the periods in which the atmospheric factor "moisture" is critical for the crops, the harvest is always much reduced. Hence the necessity for taking every precaution to preserve the moisture in the soil by preventing evaporation and dispersion. Maize, during the 3 months of its growth, requires at least 7.5 inches of rain. In-

ther words, the summer rainfall in June to August is the most important or maize.

The following data show the quantity of rainfall during the said eriod and the yield of grain (maize) : —

Summer rainfall	Bushels of maize per acre
ess than 7 inches.	25.3 (8 year average)
etween 7 and 10 inches.	32.4 (9 » »)
fore than 10 inches.	39.8 (11 » »)
fore than 13 inches.	45.9 (7 » »)

There is, therefore, a difference in yield of 20.6 bushels corresponding o the minimum and maximum rainfall.

TEMPERATURE. — Between the districts of the extreme north and those f the extreme south there is a difference of 11° F. in mean temperature nd a difference of 4 ½ weeks in the duration of the frostless season. Such ifferences cause noticeable effects on the distribution of crops, and while he cotton plant grows in the southern limits of the State, the cultivaion of maize in the northern limitis, though limited to early maturing arieties, is sometimes damaged by destructive early autumn frosts.

In the lower third of Illinois, high temperatures hinder the growth f oats which, on the other hand, constitutes one of the commonest crops n the northern districts.

To insure the normal growth of any crop a certain number of hours re required during which the temperature remains above the minimum or growth. These are " degree-hours ", obtained by multiplying the umber of hours during which the temperature is above the minimum y the difference in degrees between the average temperature during the eriod of growth and the minimum required for growth.

For the various groups of districts into which Illinois has been subdirided we have the following degree-hours calculated according to the averge temperature on May 20 and September 15 and taking 49° F as the inimum temperature for the growth of maize : —

Districts	Degree-hours
Extreme northern	57 910
Central northern	60 860
Central	67 240
Central southern	72 800
Extreme southern.	76 560

From 1876 to 1915 for the State as a whole the average number of legree-hours was for the growing period of maize, 66 708 per year, with a naximum of 75 240 in 1901 and a minimum of 57 930 in 1882. In 1901, the

yield was 21 bushels per acre and in 1882 it was 24 bushels. During the period of 40 years, in 21 years the number of degree-hours was above the average and the yield in grain averaged 30.4 bushels per acre, while in the other 19 years the number of degree-hours was below the average and the average yield 33.6 bushels. The better yields were therefore obtained in the years when the number of degree-hours was slightly below the average.

The following table sums up the data regarding the yield in grain of maize, the number of degree-hours and the rainfall for July-August at the Agricultural Experiment Station of Urbana : —

Degree-hours	Average yield in grain per acre (bushels)	Average rainfall July and August (inches)
Over 70 000	21.0	3 30
Between 70 000 and 65 000	32.6	6.05
Between 65 000 and 60 000	36.5	6.87
Below 60 000	36 6	6 82

These data, while they confirm the existence of correlation between the yield and the number of degree-hours, also indicate that there is a correlation between the latter and the rainfall, from which it may be deduced that lack of rainfall is the real cause preventing the crop from utilising the greater temperature possibilities.

FROST. — The following Table indicates the average date of the last destructive frost in spring and that of the first autumn frost, also the average number of days in the frostless season in the various districts into which Illinois has been divided : —

Districts	Last frost in spring	First frost in autumn	Duration of the frost less season
Extreme northern	May 4	October 12	161 days
Central northern	» 2	» 15	166 »
Central	April 26	» 16	173 »
Central southern	» 15	» 20	188 »
Extreme southern	» 14	» 24	193 »

164 – **The Possibility of Forecasting Summer Temperature and the Approximate Yield of Rice in the North of Japan.** — OKADA, E., in *The Bulletin of the Central Meteorological Observatory of Japan*, Vol. III, No. 1, pp. 19-32. 1 pl. Tokio, 1919.

In the north of Japan the climatic factor which decides the yield of rice is the general summer temperature, especially during August. When the air keeps at a high temperature during the latter month and when there are many hours of sunshine, the harvest is on the average a very good one.

A cold month of August is followed by poor crops, as in 1902, 1905, and 1913, when a terrible shortage prevailed in the north of Japan.

If it were possible to have a very early forecast of the August temperature, the information might be of use in connection with the harvest.

Some men of science talk of a close relation between hydrographic and meteorological phenomena on the eastern coast of north Japan, and they propose undertaking a series of systematic observations on sea temperatures for the purpose of deducing therefrom some indications as to the kind of summer to follow. Observations of such a nature, however, involve many difficulties.

A close correlation has also been discovered between the summer temperatures in Japan and the number of sun spots, but the problem of forecasting sun spots long in advance is far from being solved. In the absence of better data the author shows in his article the results of an attempt to apply statistical methods to the forecasting of summer temperatures, based on the fact that in the north of Japan temperature variations are related to barometric variations observed in March at the observatories of Zikawei (China) and Miyazaki (south-eastern coast of the island of Kiushiu), and during the period March to May at the observatories of Santiago (Chile) and Buenos Aires (Argentina). The annexed table shows the coefficients of correlation between the pressures in South America (March-May) and the August temperatures at 8 Japanese stations, in the course of 30 years' observations (1884-1913).

	Stations	Corrected coefficient	Probable error
Hokkaido. . .	Nemuro	0.496	0.093
	Sapporo	0.629	0.074
	Hakodate	0.571	0.083
Tôhoku. . . .	Aomori	0.536	0.088
	Miyako	0.462	0.097
	Isinomaki	0.627	0.075
	Akita	0.476	0.095
	Niigata	0.538	0.087

Hence there exists a positive and strong correlation. The higher the barometric pressure in March-May at Santiago and Buenos Aires in relation to the pressure of the preceding year, the higher the August temperature will be in north Japan in comparison with the temperature of the preceding year.

Between the barometric gradient Zikawei-Miyazaki (1) and the August temperature at Japanese stations there are the following correlation coefficients: Nemuro 0.341, Sapporo 0.402, Hakodate 0.402, Aomorio. 378 Myako 0.312, Isinomaki 0.465, Akita 0.391, and Nijgata 0.424., Here also the parallelism between the two groups of values, barometric and thermic, is very evident: the greater the difference in barometric values between Zikawei and Miyazaki, the higher will the August temperature be in north Japan.

(1) The difference between the pressure at Zikawei and that at Miyazaki. (*Ed.*)

Given on one hand, the close relationship between the August temperatures and the rice yield and, on the other hand, the high degree of correlation between the August temperatures in Japan and the barometrice values in March in South America and in March-May in China and south Japan (island of Kiushiu), it should thence be possible to estimate fairly roughly, from the end of spring, what the rice yield will be, after establishing the connection between the thermic values in August and the grain yield.

A moment's reflection will suffice to show how much more simple and natural it is to calculate directly the correlation coefficient between the yield of rice grain in north Japan and the barometric values at the above-mentioned stations.

In his calculations the author deals separately with the crop for the Hokkaido district (the Nemuro, Sapporo and Hakodate stations) and for the Tohoku district (Aomori, Miyako, Isinomaki, Akita and Niigata).

HOKKAIDO: the coefficient of correlation between the rice yield and the annual variation of barometric pressure in South America for the month of March is equal to 0.674. If, instead of South America, the barometric gradient of Zikawei-Miyazaki (for March) is taken, the coefficient is equal to 0.581.

TÔHOKU : the values of the coefficient of correlation are 0.459 and 0.431 respectively.

Hence the coefficients in both cases are very high. It may be concluded from this fact that in north Japan a poor rice crop in most instances is preceded by a very low barometric pressure over South America in the period March-May and by a very slight Zikawei-Miyazaki gradient (March).

165 – **Climate and Cotton Growing in the United States.** — STINE, O. C. and BAKER, O. E., in *Monthly Weather Review*, Vol. XLVII, No. 7, pp. 487-489, 12 figs. Washington, July 1919.

CLIMATE OF THE COTTON BELT. — In this belt the variations in yield per acre and the density of the cotton acreage depend principally on soil conditions. On the other hand the outer boundaries of cotton production, both to south and north, are determined almost entirely by climatic factors. The cotton belt has an average summer temperature of 77°F. along the northern boundary. In eastern Kentucky very little cotton is grown for household use in the mountains, although the summer temperature is only 74° F. In the southern portion of the cotton belt the summer temperature is 80° to 85° F., and in the Imperial Valley of California it averages 95° F.

Along the northern margin of the belt the last killing frost occurs, on the average, about April 10,and the first killing frost in autumn about October 25, so that the frostless season is about 200 days. In the southern portion of the belt the last killing frost in spring occurs about March 10, on the aveage and the first killing frost in autumn about November 25, the frostless season being 260 days or more in length.

The average annual precipitation in the Cotton Belt ranges from 23 inches in western Oklahoma and Texas to 55 inches in eastern North Caro-

lina and 60 inches in southern Mississippi, and it is always heavier in the Mississippi Valley States than in Texas or the South Atlantic States.

The summer rainfall is somewhat greater than that of the other seasons, especially in the southern and eastern portion of the belt, reaching a maximum of 30 inches in southern Mississippi and in eastern North and South Carolina, while in the Black Prairie of Texas the amount averages only 8 inches.

Autumn is the driest season of the year, practically all the important cotton regions receiving less than 10 inches of rain during the autumn months.

WEATHER CONDITIONS FAVOURABLE FOR COTTON : a mild spring with light but frequent showers ; a moderately moist summer, warm both day and night ; a dry, cool and prolonged autumn. Too cool weather in the spring retards growth, and too much rain may induce the seed to rot rather than to germinate or later cause the development of surface roots, to the sacrifice of the deeper roots, resulting in wilting and shedding of leaves and bolls during drought.

May and June particularly are critical months, when heavy rainfall, especially if accompanied by low temperatres, is very detrimental.

Drought in the spring often kills the young shallow-rooted seedlings.

A wet summer promotes vegetative growth at the expense of boll production, while drought stunts the plants, causes early maturity and reduces the yield.

The most unfavourable conditions for the crop are a cool and wet May and June, followed by a hot and dry July and August.

The ideal rainfall is of the thundershower type with several days of bright, warm weather between rains. Plenty of sunshine is especially important in June and early July when the plants are in bloom.

When the cotton matures and the bolls begin to open in the latter part of August, rainy weather is undesirable, as it retards maturity, interferes with picking, and discolours or damages the exposed fibre. Moderate rain in early September, however, favours the production of a large top crop of late maturing bolls. The greater daily rage in temperature in a dry autumn is also favourable to the maturing crop as it checks vegetative growth and induces fruiting. Early frost in autumn kills the top crop on the upper branches of the plant or causes the bolls to open prematurely, often seriously reducing the yield.

DATES OF PLANTING AND PICKING. — Cotton planting generally begins in the southern portion of the cotton belt about March 20, and progresses northward ; in the central portion planting begins during the first week in April, and in the northern portion about April 20. It lasts usually 2 to 3 weeks.

In extreme southern Texas chopping out begins in April, in the southern districts in May, and in the northern districts between June 20 and July 5.

Cotton picking begins about August 10 in the south, in the last weeks of August in the centre and only about September 10 in the northern portion of the belt.

166 – **The Influence of Pruning on the Resistance of Fruit Trees to Cold: Investigations in the United States.** — WHITTEN, J. C., in *Monthly Weather Review*, Vol. XLVII, No 8, p. 570. Washington, August, 1919.

The general condition of a plant at a given time, the degree of maturity or quiescence, the quickness of growth, have all a more or less marked influence on the plant's resistance to unfavourable surroundings.

Investigations made at the Missouri Agricultural Station have shown that sap concentration is least (minimum sugar content) during the periods of rapid growth in spring and at the beginning of summer.

The supension or slowing of growth brings about an ever-increasing concentration of sap, with a rise in reserve stores.

The earlier that growth stops in autumn, the greater will the concentration of sap be and the greater will the quantity of reserve material be.

On the other hand, as the degree of concentration increases, the freezing point becomes lower and thus the plant is able to stand lower temperatures than would be the case if the juices were weaker.

For example, in a peach orchard, vigorous growth of branches continued up to the first autumn frosts. The following spring the blooms were killed in a single night by a fall of temperature to — 2.78° C.

In another orchard in the same district, growth stopped much earlier, while the leaves kept healthy and active until the first frosts.

The following spring the flowering buds were very resistant to frost.

PRUNING. — With the old pruning methods, trees underwent every winter a very severe pruning which brought about a vigorous growth of shoots at the ends of the pruned branches. These shoots continued lengthening and producing leaves all summer, thus preventing the concentration of sap and the storage of reserve material.

With the new pruning system, on the other hand, the main branches are untouched; they are only cleared every year by the removal of useless side branches, so that growth stops early.

These branches and their leaves, of slow growth, have compact tissues, evaporate and transpire very little and thus keep their sap concentrated. In addition, the leaves do not remove moisture from the fruit during dry seasons.

By this pruning system not only is resistance to low temperatures obtained, but also resistance to drought.

167 – **A New Acid and Alkaline Scale especially for Soils.** — WHERRY, E. T., in *Journal of the Washington Academy of Science*, Vol. IX, No. 11, pp. 305-309. Washington, 1919.

The author proposes a new scale for acid and alkaline reactions, introducing the idea of *specific acidity* and *specific alkalinity*, the unit of which instead of being the gramme-equivalent per litre is the number of gramme-equivalents of each ion (hydrogen or hydroxyl) present in distilled water at the usual temperature. These values would represent the respective chemical potentials and according to a suggestion of ADAMS are indicated by the letter X, the initial of the Greek word meaning " chemical ".

In this scale the values for the hydrogen ion represented by X_H, are

such that neutrality is shown by $X_H = O$, and are obtained by subtracting the exponent P_H from the value 7 (1).

The annexed table gives a summary of the values corresponding to the most probable reactions in the soil.

Scale of Soil Reactions.

Generic reaction	Usual method				Proposed new method				Denominations proposed for the specific reactions
	H +	OH −	P_H	P_{OH}	Specific acidity	Specific alkalinity	X_H	X_{OH}	
	10^0	10^{-14}	0	14	10^7	10^{-7}	7	− 7	
	10^{-3}	10^{-11}	3	11	10^4	10^{-4}	4	− 4	superacid
Acid . . .	10^{-4}	10^{-10}	4	10	10^3	10^{-3}	3	− 3	mediacid
	10^{-5}	10^{-9}	5	9	10^2	10^{-2}	2	− 2	subacid
	10^{-6}	10^{-8}	6	8	10^1	10^{-1}	1	− 1	minimacid
Neutral . .	10^{-7}	10^{-7}	7	7	10^0	10^0	0	0	minimalkaline
	10^{-8}	10^{-6}	8	6	10^{-1}	10^1	− 1	1	subalkaline
	10^{-9}	10^{-5}	9	5	10^{-2}	10^2	− 2	2	medialkaline
Alkaline. .	10^{-10}	10^{-4}	10	4	10^{-3}	10^3	− 3	3	superalkaline
	10^{-11}	10^{-3}	11	3	10^{-4}	10^4	− 4	4	

In the relations between acids and plants there may be noted, with regard to reactions thus designated, certain more or less well defined types: peat infra-acquatic, super acid, with a characteristic flora, oxylophyte or acidophil; supra acquatic peat, mediacid, also with a oxylophyte flora; ordinary forest and subacid field soils; limy soils, subalkaline; alkaline lands, medialkaline and superalkaline.

One of the advantages of the proposed scale would be the facility for making comparisons and it may be applied to all determinations hitherto expressed with the SÖRESNEN exponent (P_H).

168 – **Changes in Composition of the Soil and of the Water Extract of the Soil Following Addition of Manure.** — HIBBARD. P. L. (University of California), in *Soil Science*, Vol. VII, No. 4, pp. 259-272. 3 Figs. Bibliogr. of 14 works. Baltimore, 1919.

Fresh manure was mixed with loamy soils in the proportion of 1, 2 and 5 %, the mixtures were kept at optimum moisture point and analysed, during the year, from time to time.

It was found that carbon dioxide in the soil atmosphere was increased in proportion to the manure added, but, in the year's trial, the carbon

(1) See *R.*, Feb., No. 159 (*Ed.*).

decreased, while the nitrogen remained constant. Water-soluble matter at first decreased, as compared with untreated soil, then increased but without ever equalling the sum of that in the soil plus that in the added manure. Nitrate quickly disappeared, and later reappeared and increased in proportion to the manure used.

The above, in short, is a confirmation of the fact that fresh manure should not be added to a soil just previous to or during the time a crop is growing. It should be remembered, however, that these experiments were made with glass jars.

169 – **The Influence of Heated Soils on Seed Germination and Plant Growth.** — Johnson, J. (Department of Horticulture, Wisconsin Agricultural Experiment Station) in *Soil Science*, Vol. VII, No. 1, pp. 1-87, 9 pl., bibliography of 79 publications. Baltimore, 1919.

The method of sterilising soils by the action of heat is more and more appreciated: the phenomena met with in this method of treatment are complex and form the subject of an extensive scientific literature.

Besides the phenomena which have been noted in the soil itself, the author deals with the changes which take place in heated soil; he regards them from the standpoint of their effect on seed germination and on plant growth and he endeavours to draw from them conclusions on the subject as to the probable natures of these changes. It appears from observations made that, generally, when heated to 100°-115° C., all soils retard both seed germination and plant growth, but this retardation is followed by increased vigour of growth; the degree of these actions varies according to the soil, seed, and plants used and the conditions under which the experiments are carried out. In a series of trials made with 7 different soils heated to temperatures varying from 115° to 500° C. and using various seeds and plants, a general and gradual toxic effect was noticed on germination and first stages of the growth of the plants; the toxicity reached its maximum in soil heated to 250° C., then decreased at higher temperatures and became practically nil at 350° C. or above. At any rate, the soils cease to be toxic after a time and do so sooner when the intensity of toxicity is less; on the other hand, the final beneficial action of heating is greater when the toxicity is more intense at the commencement of growth.

The toxic action caused by heating soils and the subsequent beneficial action that results, vary in a marked manner according to the nature of the soils; these differences appear to be correlated with the balance of all the various factors which affect the soil tested.

Seed of different plants also vary in a marked manner in their resistance to the toxic action of heated soils, which depends largely on the family to which they belong: — the Gramineæ and the Cucurbitaceæ are usually resistant, while the Leguminosæ and the Solanaceæ are more sensitive. However, seeds classed as sensitive may show accelerated germination in soils which do not become highly toxic or which have been only slightly heated. Like the seeds, the plants themselves differ much in their sensitiveness to the toxic action of heated soils although there may not always

be parallelism with the influence of toxicity on germination even in the same species.

In certain heated soils the growth of fungi, especially those of the genus *Pyronema* is similar, as regards toxicity to germination and plant growth, to that of higher plant species ; fungi, and apparently, bacteria grow very well in soil previously heated to 250° C., that is to say, in soils most toxic to seeds and plants. The ammonia content and the concentration of the soil solution of a soil heated to various temperatures are highest at about 250° C., and they diminish gradually with an increase or decrease in the temperature of heating ; both are correlated with the initial toxic action, caused by heating the soils, on germination and early growth, with the later beneficial action which follows, and with the growth of lower micro-organisms in the soil. This correlation is only true for a given soil and not for all soils. The absorptive capacity of a soil appears to have an influence on its toxicity, for it has been noticed that the toxicity to germination of water extracts of various heated soils is more directly proportional to the ammonia content. The author considers that the toxic action in heated soils is mainly due to the ammonia produced during the heating from ammonium carbonate which, in normal conditions, would be gradually decomposed ; as a matter of fact the addition of ammonia in varying amounts to a soil produces effects on germination and plant growth in many respects similar to those caused by heating. Similar effects of high toxicity on the germination of certain seeds can be obtained with heated soils or their extracts and equally with certain strengths of ammonia, and these effects cannot be reproduced except with ammonia or ammoniacal salts.

At any rate, the toxic substance produced by heating the soil is recovered or transformed into non-toxic compounds in soils kept under normal conditions of cultivation, and this is caused by the activity of the ordinary soil flora ; however, this flora may, at least apparently, increase the ammonia present, which, according to the author, is not, however, found in the free state but in the form of transition compounds which are decomposed in the analytic processes.

The temperature at which the soil is kept after heating has great importance so far as the permanence of toxicity and the commencement of beneficial action are concerned, the toxic action being more persistant and destructive below 25° C.

It should be noted that all the above mentioned conclusions apply particularly to soils heated to high temperatures and in a dry state, but the author believes that there are no fundamental differences between soils partly sterilised by steam and soils heated to higher temperatures and reinoculated with normal soil flora.

It should not be overlooked that the destructive action noted, should not diminish the value of sterilising the soil by heating both for research and practical purposes ; it is even a treatment to be recommended (especially steam sterilisation) whenever it is necessary to eliminate certain organisms from the soil ; but in that case a slight retardation in growth must be expected (which will always be followed by benefit) and in these

special cases (relating to both the soil or plants or in certain environments) marked changes in the normal course of growth are to be reckoned with.

170 – **Progress of Irrigation in India, Egypt and the Sudan.** — I. *Statement Exhibiting the Moral and Material Progress and Condition of India during the year* 1917-18, No. CIV, pp. 141-147. London 1919. — II British India, Progress of Irrigation. *The Board of Trade Journal*, Vol. VIII, No. 1192, p. 419. London, 1919. — III. *Report on the Progress of Agriculture in India for* 1917-18, pp. 107-111. Calcutta, 1919. — IV. CUNNINGHAM, B., Irrigation in Egypt and the Sudan. *Nature*. Vol. CIV, No. 2003, p. 67. London, 1919.

I, II, III. *Irrigation in India.* — Two-thirds of the population of India live by agriculture, and one of the most important conditions of the growth of agriculture is the irrigation system. There are four methods by which irrigation is carried out in India. The first is by placing some form of barrage across a river which flows throughout the year and diverting the water by means of a canal to the country to be irrigated. It is on this principle that the great perennial canals of northern India are constructed. The second method is by leading canals direct from rivers without the use of barrages. These canals obtain no water until the river reaches a certain height. They are known as inundation canals, and constitute the majority of the canals in Sind and many of those in the south-west of the Punjab. The third method is by building a dam across a valley and storing the rainfall water during the monsoon, the water so held being distributed to the neighbouring lands by means of canals. The reservoirs thus formed vary in size from the tiny village tank to the monumental works in the western Ghauts, with masonry dams up to 270 ft. in height. The fourth method is by lifting water from wells, either by indigenous and primitive methods such as the leathern bag drawn by bullocks and the Persian wheel, or by means of power-driven pumps.

For financial purposes, Government irrigation works are classified as productive, protective, or minor works. The capital outlay on works of all three classes to the end of the year 1917-18 amounted to about £ 50 000 000 and it is significant that over three-fourths of this amount was expended on productive works. These are works which are expected to pay all charges, including interest, within ten years of completion, and it speaks well for the efficiency of their construction and management that in 1917-18 the receipts, including land revenue due to irrigation, not only met all expenses, including interest, but yielded a net profit of £ 2 000 000. There are now over 66 000 miles of main and branch canals and distributaries, from which an area of nearly 26 000 000 acres is irrigated.

An estimate has been made that the value of the crops irrigated by Government works in a single year exceeds by more than 25 per cent. the total capital outlay on such works. It would be difficult to frame in a single sentence a more striking illustration of the benefits of irrigation in India.

Several new irrigation schemes which have been under investigation are of the first magnitude. There is the Sukkar barrage project in Sind, which provides at an estimated cost of nearly £ 7 500 000 a weir across the Indus, with two large canals taking off from the right and left banks of

the river to supply water for the perennial irrigation of areas now dependent on inundation canals. Another extensive project is that of the Sind-Sagar-Doab canal in the Punjab, which comprises a barrage on the Indus river, with an extensive canal system providing for the irrigation of some 200 000 acres at a cost of nearly £6 000 000. Also in the Punjab, on the Sutlej, is the site of the Bhakra Dam, estimated to cost £7 000 000 and designed to store water to a height of 360 ft. above the river bed. About 1 400 000 acres will be irrigated and the dam, if built as now designed, will be higher than any in existence. In Madras, the Cauvery (Metur) reservoir project contemplates a dam, a canal seventy-eight miles long, and a connected tributary system, costing altogether between £2 000 000 and £3 000 000. It is estimated that over 370 000 acres of land will be brought under irrigation and that provision will be made for the complete control of the present fluctuating supplies of the Cauvery delta system. In Oudh, a canal is proposed which will, if constructed, rank among the largest irrigation works in the world. The net capital outlay is estimated at about £5 750 000 and the gross area commanded by the works will be over 8 000 000 acres though only 2 000 000 acres will be irrigated annually. Larger still is a scheme for irrigating more than 3 000 000 acres in the Sutlej valley.

Altogether there are thirty-four major works either under construction, awaiting sanction or in course of investigation in India. If these works are all undertaken they will extend the benefits of irrigation to an additional area of about 11 000 000 acres a year at an estimated cost of £32 000 000 and should produce a net revenue of nearly £2 5000 000.

The Review of Irrigation in British India during 1917-18, recently published by the Public Works Department of the Government of India, shows that during the year the total area irrigated by all classes of works amounted to nearly 26 000 000 acres. Towards this area, productive works contributed 16 922 000 acres (in the Punjab 7 500 000 acres, Madras Presidency 3 500 000 acres, United Provinces 2 871 000 acres, and Sind 1 364 000 acres). The total capital outlay of the year on productive irrigation works amounted to nearly 57 $^{3}/_{4}$ crores of rupees. The gross revenue reached 701 $\frac{1}{2}$ lakhs of rupees, and working expenses nearly 216 $^{3}/_{8}$ lakhs. The net revenue, at a little over 485 lakhs, represents a return of 8.40 % on the total capital outlay. The total areas irrigated by thirty-six protective works in operation amounted to 497 000 acres. The net revenue was only a little over one lakh, equivalent to 0.10 % on the total outlay. This low return is partly due to expenditure on works under construction which are not yet earning. Many useful and important works of this nature are under construction in Bombay, the United Provinces and the Central Provinces, while in the last-named province seven tank schemes (aggregating over 40 lakhs) are in progress. The area irrigated by minor works was 8 477 000 acres. The total capital outlay was 448 lakhs and the net revenue amounted to Rs.35, 39,000.

Finally, there are at least 3 000 000 wells in India from which water is lifted for irrigation and the number of men and cattle employed on this

work is very large. The question of pumping water from wells, as well from river channels and watercourses, is a very important one to India, subject as it is to extensive and serious failures of the rains. There are large areas of land which border on rivers retaining an ample supply of water throughout the hottest weather and such land can be effectually protected from drought by the installation of pumping machinery. The Indian Irrigation Commission of 1901-03 reported that the area under well inrrigation was not less than 16 000 000 acres.

IV. *Irrigation in Egypt and the Sudan.* — The schemes of Nile irrigation at present in hand include three separate projects relating to different sections of the river. There is a scheme for the development of the Gezirah plain of the Sudan on the Blue Nile, just south of Khartoum ; another for the benefit of Egypt proper by utilising the flood-waters of the White Nile ; and a third scheme of drainage improvement of the deltaic region included in the provinces of Gharbieh and Beheira, lying below Cairo.

The Blue Nile scheme consists of a dam at Makwar, about five miles south of Sennar and 175 miles south of Khartoum, with a canal, some forty miles in length, leading from just above the dam to the district to be irrigated, which is a remarkably level and treeless plain some 300 000 feddans in extent (1 feddan = 1,04 acre). The cotton, which it is capable of producing, will be raised as a winter crop, absorbing the river winter supply without interfering with the summer discharge. The dam will be a work of some magnitude, withstanding, when completed a head of 40 ft. of water, and capable of coping with a discharge of some 1 250 000 gallons per second in a river subject to sudden and extreme fluctuations.

The White Nile scheme is, fundamentally, a development of the Aswan undertaking, which has now reached the limit of its effective utility. In 1916, the demands of the area under cultivation exceeded the available supply. It is, accordingly, proposed to construct an auxiliary reservoir dam at Gebel-el-Auli, or Gebel Aoli, on the White Nile, capable of impounding an adequate summer supply supply of water for Egypt, and at the same time reducing the excessive flood-waters of the main Nile. This scheme has been the subject of certain criticisms by Sir William Willcocks.

A subsidiary work is the formation of a channel from the Blue Nile above Sennar, so that the superfluous water from that reservoir may be conveyed to the Gebel-el-Auli reservoir. The Gebel-el-Auli dam will have a pressure-head of 23 ft.

The increased water supply to Lower Egypt, due to the Aswan reservoir, has severely taxed the drainage channels of the provinces of Gharbieh and Beheira, forming the alluvial plain between Cairo and the sea. It is necessary to find some measure of relief, and a solution of the problem is sought in the construction of large pumping installations on the borders of Lake Mareotis and Lake Borollos.

171 - **Utilising the Waterfalls of the Irian, in Indo-China, for the Industrial and Agricultural Development of the Colony.** — *Ministère des Colonies, Bulletin de l'Agence Générale des Colonies* (formerly *Bulletin de l'Office Colonial*), Year CII, No. 142, p. 591. Paris-Melun, Oct., 1919.

The famous falls of the Irian are destined to furnish great hydraulic power hitherto neglected in Indo-China and are capable of giving new impetus to the industrial and agricultural development of the country.

A valuation of this wealth in " white coal " has been ordered by the Governor General, who has decided to lend his patronage to a company now being formed for its exploitation.

172 - **Irrigation of Olive-trees in Tunis.** — See No. 206 in this *Review*.

173 - **The "Sortume".** — TARCHETTI, A., and TOURNON, A., in *Il Giornale di Risicoltura* Year IX, No. 8, pp. 113-125. Vercelli, August, 20 1919.

" Sortume " (from *sorgere* = to gush up, break out) is the name given by the farmers of Piedmont and Lombardy to the unfavourable circumstances (peculiar to the irrigated alluvial district and due precisely to the welling up or rise of water from the lower strata to the surface of the soil) which give the land an excess of moisture, and consequently of acidity which is constant and cannot be diminished by means of ordinary cultivation. The " sortume " gives rise to a kind of seeping which makes the soil dark and shiny, and in the worst cases gives it a sort of characteristic irridescent viscosity which makes cultivation, and especially ploughing, exceedingly difficult. Flooding the land does not prevent the formation of the " sortume ", which, when it appears in rice fields, assumes an exceptionally important and serious aspect. This hydraulic phenomenon happens over areas varying from a few ares to several hectares. The usual methods adopted to try and combat it are: — deep ploughing; a close network of drainage trenches; the application of quicklime, heavy green manuring; etc., but all these are merely palliatives and do not affect the causes of the phenomenon.

In places affected by the " sortume " the vegetation, though flourishing at the beginning of the agricultural season, comes to a halt, wilts and sometimes dies off. The fact that plants whose roots require water are also damaged by the " sortume " shows that the wilting is not due to the water which moistens the roots but to the quality of this water. The latter is, in fact, cold and unaerated, so that it cannot support root respiration. The want of oxygen helps the formation of acidity in the soil.

In places where the "sortume " appears, the water rises under pressure from below, the causes of which, varying according to the case, are under investigation by the authors.

In alluvial soils, the " sortume " is often a consequence of communicating chambers, in which case the remedy lies in purely hydraulic measures, namely in cutting the closed seam in which the water circulates.

It not unfrequently happens, however, that the " sortume " appears in regions far from rivers and torrents and keeps on after the ground and

canals round about are dried up, even within a radius of several kilometres. Some writers conclude from this fact that the " sortume " may arise from the inexhaustible underground streams, which are common in alluvial districts. But as the " sortume " appears almost exclusively during the irrigation periods, and as it disappears at the times when the canals are generally dry, this shows that, as a rule, these natural underground streams are not the cause, but small veins very near the surface, fed by the canals or by the surrounding submerged ground. Again, in places where underground streams are abundant the " sortume " phenomena are much more in evidence and form real springs which it is easy to tap and drain off. Usually these points where water rises are to be found at the foot of earth terraces, and in most cases the presence of peat is typical of them.

It must be allowed that the "sortume " wells up under pressure when the zone of earth causing the pressure lies much higher than the zone in which the " sortume " takes place, but this no longer holds good when the higher ground is only a few decimetres above and the distance very great. In the latter case, it is much more likely that the phenomenon is due to capillary action raising masses of water which lie at a constant level in the subsoil. Here the *quantity* of water rising increases with the porosity of the soil, but the *height* to which it reaches (viz. the capillary raising force) is inversely proportional to the porosity. Therefore, on digging several holes of different depths in soil where the " sortume " appear, if the latter is caused by pressure, water will collect in a short time at the bottom of all the holes and will stand at the same level in each, or, if the holes are very far apart, at only slightly different levels (these differences may serve to indicate the direction of the subterranean current, and consequently act as a guide to find the source of the permanent mass of water). If, on the other hand, after a certain time, the bottom remains simply damp as at the surface of the soil, or if water collects only in the deepest holes and in these reaches the same level, it is almost certain that the " sortume " is due to capillary action and that the water level in the deepest holes corresponds to that of the water causing the phenomenon.

Remedies. — When the " sortume " is produced by the pressure of water near-by, it can be located as either more intense on the boundary of the field (in this case it appears by direct infiltration) or confined to the points of strongest pressure (in this case the water is brought by a subterranean channel in the form of a syphon. In the former instance the " sortume " may be got rid of by digging a single deep drainage channel along the edges of the field ; in the second instance the flooded or muddy parts must be connected to the drainage channel by means of trenches, cement piping or underground drains, or else the soil level must be raised by bringing earth to the place.

When the " sortume " is caused by capillary absorption, much deeper ploughing than usual must be resorted to, or at least very deep subsoiling. It would be of still greater value if the deep ploughing were accompanied by very heavy green manuring or by a previous dressing of sand (preferably of a loamy type), which immediately neutralises

the acidity of the soil and in addition permanently increases the porosity, especially in the lower layers, thus forming the most effective barrier against capillary action.

TILLAGE AND METHODS OF CULTIVATION

174 – **A Review of the Literature on Tillage.** — SEWELL, M. C. (Agronomy Department, Kansas Agricultural Experiment Station, Manhattan), in *Journal of the American Society of Agronomy*, Vol. II, No. 7, pp. 269-209, bibliography of 70 publications. Lancaster, Pa., 1919.

The heaviest expense in producing cereal and annual forage crops is on account of tillage : — ploughing and cultivation. The depth and frequency of ploughing, the number of weedings have a material influence on on the cost of production of a crop. The prevailing opinions on the subject are, however, so conflicting that a review of the literature relating to it is most opportune. After recalling to mind the forerunners (TULL, PRIESTLEY), then the classic agriculturists of the 19th century, and lastly modern authors, the author points out that the prevailing theories regarding deep and frequent ploughing are not founded on experimental data and he formulates the following conclusions : —

(1) Ploughing deeper than 7 inches does not generally cause an increased yield.

(2) Shallow ploughing may produce as great yields as deeper ploughing, but the depth less than 7 inches which is best for economic production has not been determined.

(3) There are not sufficient data to determine the expediency of frequent ploughing, but it appears that a suitable rotation of crops enables the number of ploughings to be decreased.

(4) Cultivation may be necessary only to extirpate weeds or to put the soil into condition for absorbing rainfall ; it is therefore, practical, except in very heavy soils, to reduce the amount of cultivation where it is intended primarily to maintain a soil mulch.

(5) Many soils have naturally sufficient aeration, without cultivation, to insure optimum bacterial and chemical activity.

MANURES AND MANURING

175 – **Lime Requirements in the Soil Determined Chemically and Physiologically.** — HARTWELL, B. L., PEMBER F. R. and HOWARD, L. P. (Agricultural Experiment Station of the Rhode Island State College), in *Soil Science*, Vol. VII, No. 4, pp. 279-282. Baltimore, 1919.

Experiments made with lettuce and beet (lime-loving plants) in pots containing a normal soil which had received a copious application of nitrogen, phosphoric acid and potash, plus varying amounts of slaked lime. Liming caused an increase in the yield, but after the maximum crop was reached, further liming did not further increase growth, although the lime requirement of the soil was chemically still considerable. The addition of superphosphate to unlimed pots caused an increased growth in lettuce in spite of a markedly increased lime requirement in the soil as determined by chemical examination. This tends to show that the elimination of the effects of alumina in acid soils is of greater importance than the neutralisation of the acidity.

176 – **The Comparative Value of Various Forms of Agricultural Limestone.** — STEWART, R. and WYATT, F. A. (*Illinois Agricultural Experiment Station*) in *Soil Science*, Vol. VII, No. 4, pp. 273-278. Baltimore, 1919.

The beneficial effect of liming and specially the great value of ground limestone on acid soils has been fully realised in the United States, only within the last few years. There are some questions, however, regarding the use of limestone which remain to be settled: —

(*a*) Can dolomitic limestone be used successfully on acid soils and what is its value compared with limestone containing a high percentage of lime?

(*b*) What is the comparative value of finely ground limestone and coarse limestone which is cheaper?

(*c*) What is the duration of the action of various kinds of lime applied to soils?

(*d*) What effect has the application of limestone on the surface upon the acidity of the subsoil?

(*e*) What is the annual loss of lime from the soil and what are the factors in such loss?

The authors' experiments, made on acid soils, have enabled them to prove that, after the initial acidity has been neutralised, an application of 1 ton per acre of limestone is sufficient to keep the soil alkaline for 4 years and that dolomitic limestone is equally effective. There is no difference in the effect of finely ground and coarsely ground limestone; the latter is even better retained by the soil. Limestone applied on the surface penetrates slowly and, after many years, reaches a depth of 6 to 20 inches but never gets down to the subsoil. The annual loss of lime from the surface layer 20 inches deep varied from 542 lb. to 760 lb. per acre. Among the causes of loss, other than the state of the limestone applied as has been indicated above, are the amount of limestone and its nature. There always remains some lime in the soil which does not act on the acidity, so that the loss of lime may be less than is indicated by acidity determinations.

177 – **The Action of some Common Fertilisers and Manures.** — GREAVES, J. E. and CARTER, E. G. (Utah Agricultural Experiment Station), in *Soil Science*, Vol. VII, No. 2, pp. 121-160, 2 fig., bibliography of 165 publications, Baltimore, 1919.

After a full account of the works hitherto published in scientific literature on the various soil amendments and stimulants, the authors report some laboratory experiments on the action of various salts on the nitrogen and phosphorus of the soil in their various forms.

It stands confirmed that the sulphates of magnesium and calcium, the chlorides of sodium, potassium, magnesium and calcium, the nitrates of potassium, calcium and magnesium, also the salts of manganese and iron generally, can be efficient stimulants of soil fertility.

The stimulating action would be due, in certain cases, to an increase of available phosphorus, in the soil and in others to an increase in nitric nitrogen, increases caused by the action of the salts in question and sufficient to explain the additional yield corresponding to their application.

A remarkable increase is that of nitric nitrogen, which, in the case of sulphate of calcium, may be as much as 97 %. The increase of available phosphorus, either in the form of soluble phosphoric acid or in the form of organic phosphorus, was noted in all cases but two: namely with nitrate of manganese and with carbonate of magnesium. The maximum increase in soluble phosphoric acid was caused with nitrate of magnesium (15.5 %) the increase in organic phosphorus was greatest with carbonate of manganese (62.6 %).

While sulphate of calcium is the strongest stimulant for rendering more nitrogen available, carbonate of manganese acts similarly for phosphorus in the combined increase of its two forms (soluble phosphoric acid and organic phosphorus).

178 – **Ammonia Fixation by Gypsum.** — Bear, F. E. and Workman, A. C. (Department of Agricultural Chemistry and Soils, The Ohio State University), in *Soil Science*, Vol. VII, No. 4, pp. 283-291, figs. 1, bibliography of 21 publications. Baltimore, 1919.

It has been found that the addition of gypsum to manure prevents the volatilisation of ammonia. To verify the truth of this the authors have made laboratory experiments in which they used, instead of manure, filter paper pulped fine and dried; this was intimately mixed with pure sulphate of calcium and a solution of carbonate of ammonium was poured over the compacted material so as to bring the water content of the mixture to 75 %; the proportions of the ingredients were calculated so as to represent 300 pounds of gypsum, in the form of sulphate of calcium, and 19.29 pounds of nitrogen per ton of material. The bottles containing the mixture were heated to temperatures ranging between 20°-85° C., and a current of moist air, freed from which carbonic acid and ammonia, was passed through the mixture into absorbtion bottles containing standard acid solutions; the experiment lasted for 95 days; the aspirations were of 10 minute periods and were made from time to time at intervals ranging from 4 times in 9 days to 10 times in 5 days.

The nitrogen loss at the end of the experiment was 11.84% of the amount applied, while in the case of the experiment without gypsum made simultaneously, the nitrogen loss was 58.29 %. At higher temperatures, above 30° C., nitrogen was lost in a greater proportion and consequently less was retained by the gypsum. Under the conditions in which the experiment was carried out the reaction would be an ordinary double decomposition between the sulphate of calcium and the carbonate of ammonium, a reversible reaction if moisture was decreased; in manure there are naturally more reactions, chiefly subsequent.

To sum up, the treatment of manure with gypsum in the proportion of 300 pounds of sulphate of calcium per ton of manure would effect a satisfactory ammonia fixation when there is enough water to soak the gypsum; whether that ammonia would remain fixed subsequently and whether the addition of gypsum to manure is economical, are questions which are not answered by the authors' experiments.

179 – **The Fertiliser Situation in Scandinavia (Sweden, Norway and Denmark)** (1)
— SEBELIN, J., in *Nordisk Jordbrugsforsking*, No. 3, pp. 104-126. Copenhagen, 1919

In the article analysed, the question as to the chemical fertilisers required in agriculture in Scandinavia is dealt with from 3 points of view : —

1) The quantities of potash, nitrogen and phosphoric acid removed from the soil by crops.

2) The quantities of potash, nitrogen and phosphoric acid returned to the soil as manure or excrement ;

3) The requirements in chemical fertilisers, studied also in relation to local production and importation.

DENMARK. — For this country the author uses the data of the Central Bureau of Statistics to calculate the average yield for the period 1909-1913. For a better understanding of the data collected in Table I,, it may be mentioned that the aerial parts of the potato, roots, sugar beet and chicory plants is calculated at $^1/_8$, $^1/_3$ and $^1/_5$, respectively, of the yield in tubers or roots.

TABLE I. — *Quantities (in metric tons) of nitrogen, phosphoric acid and potash removed from the soil by the crops in Denmark.*

	Total crops	Percentages of			Total quantities contained in the crops		
		Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash
Wheat	147 700	2.00	0.80	0.50	2 954.0	1 181.6	738.
Rye	448 300	1.90	0.85	0.66	8 517.0	3 810.6	2 958.
Barley	543 000	1.53	0.80	0.70	8 307.9	4 344.0	3 801.
Oats	774 700	1.70	0.70	0.50	13 169.9	5 422.9	3 873.
Cereals and legumes mixed	362 900	1.60	0.75	0.60	5 806.4	2 721.7	2 177
Buckwheat	2 400	—	—	—	56.9	35.9	15
Legumes (seeds)	8 700	3.60	1.00	1.25	—	87.0	108
Autumn cereal straw	1 000 000	0.60	0.64	0 95	6 540.0	2 616.0	10 355
Spring » »	2 420 000	0.80	0.18	1.30	10 460.0	4 356.0	31 460
Legume straw	20 000	1.40	0.30	0.60	—	60.0	120
Potatoes (tubers)	841 400	0.30	0.12	0.60	2 524.6	1 009.1	5 048.
Potatoes (leaves & stalks)	105 175	0.30	0.15	0.45	315 6	157.8	473
Mangels	12 004 900	0.18	0.11	0.35	21 608.8	13 205.5	42 017
Mangel leaves	4 001 633	0.30	0.09	0.28	12 004.9	3 601.5	10 004
Sugar beet and chicory	809 000	0.18	0.08	0.23	1 456 2	647.2	1 860
Aerial parts of do	161 800	0.32	0.10	0.48	566.3	161.8	647
Hay	1 100 000	1.70	0.50	1.80	9 350.0	5 500.0	19 800
Green fodder) food units.	1 500 000	—	—	—	—	—	—
calculated as (hay	3 750 000	1.56	0.61	1.95	58 500.0	22 700.0	73 125
Totals for 2 581 256 hectares of arable land, in m. tons					**171 039.0**	**71 618.6**	**208 583**
Totals per hectare of arable land, in kg.					**66.7**	**27.7**	**80**

(1) See : INTERNATIONAL INSTITUTE OF AGRICULTURE, *Production and Consumption Chemical Fertilisers in the World*, 2nd ed. Rome, 1914 ; *International Movement of Chemic Manures* ; *R.*, 1918, No. 962. (*Ed.*)

TABLE II. — *Quantities (in metric tons) of nitrogen, phosphoric acid and potash removed from the soil by the crops in Norway.*

	Total crops	Percentages of			Total quantities contained in the crops		
		Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash
Wheat	11 713.0	2.00	0.80	0.50	243.3	93.7	58.6
Rye	30 250.5	1.90	0.85	0.60	574.8	257.1	181.5
Barley	87 543.0	1.53	0.80	0.70	1 339.4	700,3	612.8
Oats	257 091.0	1.70	0.70	0.50	4 370.5	1 799.6	1 285.5
Cereals and legumes (mixed)	12 711.0	1.60	0.75	0.60	203.4	95.3	76.3
Legumes (seeds)	7 439.0	3.60	1.00	1.25	—	74.4	93.0
Autumn cereal straw	75 637.0	0.60	0.24	0.95	453.8	181.5	718.5
Spring » »	7 147 700.0	0.80	0.18	1.30	5 717.6	1 286.5	9 291.1
Legume straw	17 200.0	1.40	0.30	0.60	—	51.6	103.2
Potatoes (tubers)	10 814 700.0	0.30	0.12	0.60	3 244.4	1 297.8	6 488.8
Potatoes (leaves & stalks)	135 184.0	0.30	0.15	0.45	405.5	202.8	608.3
Hay	14 580 070.0	1.70	0.50	1.80	12 383.5	7 290.0	26 245.2
Green fodder calculated as dry matter	47 011.0	1.56	0.61	1.95	374.7	292.3	934.3
Other field and kitchen-garden plants	18 842.0	100	80	125	1 884.0	1 507.8	2 261.0
Totals for 750 740 hectares of arable land, in m. tons					**31 193.7**	**15 130.3**	**48 958.3**
Totals per hectare of arable land, in kg.					**41.6**	**20.6**	**65.2**

NORWAY. — For this country the data of 1917 are used. In order to understand better the figures in Table III it should be remembered that: — 1) the straw of autumn cereals is calculated by multiplying the grain crop of wheat and rye by $\frac{266}{173}$ and $\frac{341}{179}$ respectively; 2) the straw of spring cereals is calculated in the proportion *straw : grain* = 2 : 1.

SWEDEN. — The author makes use of the data of 1913, already elaborated by FELLITZEN (see Table III).

The next table gives a comparison of the quantities of fertilising material removed from 1 hectare in the 3 countries and shows the relation of these to the quantities removed by an average crop and by maximum desirable yield respectively.

The fact that in Sweden the quantity of fertilising material removed from 1 hectare of cultivated land is less than that found for the other two countries is a result of the greater extent and duration of the fallows practised there on the arable land, and also a result of the fact that in the present study no account has been taken, in the case of this country, of the aerial parts of potatoes, root crops and mangolds.

FARMYARD MANURE, DUNG AND LIQUID MANURE. — With regard to the fertilising power of farmyard manure, the manure proper must be distinguished from the liquid. In the latter, the nitrogenous matter exists in easily soluble form and can be used at once by plants, whereas

TABLE III. — *Quantities (in metric tons) of nitrogen, phosphoric acid and potash removed from the soil by the crops in Norway.*

	Total crops	Percentages of			Total quantities contained in the crops		
		Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash
Autumn wheat	247 156	2.00	0.80	0.59	4 943.1	1 977.2	1 235.8
Autumn rye	570 888	1.90	0.85	0.66	10 846,9	4 852.5	3 767.9
Autumn cereal straw	1 398 940	0.60	0.24	0.95	8 393.6	3 357.5	13 289.9
Spring wheat	11 454	2.05	0.85	0.60	234.8	97.4	68.7
Spring rye	13 575	1.80	0.92	0.60	244.4	124.9	81.5
Barley	368 674	1.53	0.80	0.70	5 640.6	2 949.4	2 580.7
Oats	1 401 428	1.70	0.70	0.50	23 824.3	9 810.0	7 007.1
Cereals and legumes mixed	364 244	1.60	0.75	0.60	5 827.9	2 732.8	2 185.8
Spring cereal straw	3 120 823	0.80	0.18	1.30	24 966.6	5 617.5	40 570.7
Peas	34 353	3.65	1.00	1.25	—	343.5	429.4
Haricots and beans	5 553	4.08	1.21	1.29	—	67.2	71.6
Vetches	15 190	4.40	0.99	0.89	—	150.4	121.5
Legume straw	80 479	1.40	0.30	0.60	—	241.4	482.8
Potatoes	1 969 074	0.30	0.12	0.60	5 907.2	2 362.9	11 814.4
Sugar beet	858 293	0.18	0.08	0.23	1 544.9	686.6	1 974.0
Mangolds	3 254 211	0.18	0.11	0.35	5 857.6	3 579.6	11 389.7
Hay	4 759 835	1.70	0.50	0.89	40 458.6	23 799.2	85 677.0
Linseed	85	4 80	1.35	1.00	3.2	1.1	0.9
Hax straw	222	0.41	0.08	0.03	0.9	0.2	0.1
Tobacco	792	1.64	0.92	3.82	13.0	7.3	30.3
Clover seed (1/3) and fodder-grass seed (2/3)	10 853	2.20	1.00	0.80	159.4	108.9	86.8
Green fodder, calculated as dry matter	644 632	1.56	0.61	1.95	5 028.2	3 932.3	12 570.3
Totals for 3 680 774 hectares of arable land, in m. tons					**143 895.3**	**66 798.6**	**195 436.7**
Totals per hectare of arable land, in kg.					**39.1**	**18.1**	**53.1**

	Nitrogen kg.	Phosphoric acid kg	Potash kg.
Denmark	66.7	27.7	80.7
Norway	41.6	20.6	65.2
Sweden	39.1	18.1	53.1
Average crop	50	24	66
Maximum crop	77.5	30	110

the utilisation of the nitrogenous components of the solid manure is so difficult that these constituents may be neglected in a study of this kind.

The phosphoric acid is found almost exclusively in the solid excreta, while the urine, except in the case of pigs, is practically devoid of it.

The potash is found mostly dissolved in the urine ; the potash of solid excreta may be reckoned as equal to 10 % of that contained in the urine.

Of farm stock, each animal would give per year : —

	Cattle	Horses	Sheep	Goats	Pigs
LIQUID MANURE	2000 kg.	600 kg.	60 kg.	60 kg.	180 kg.
Nitrogen	1 %	1.5 %	2 %	2 %	0.5 %
Phosphoric acid	—	—	—	—	0.15 %
Potash	1.6 %	1.6 %	2.3 %	1.2 %	0.7 %
SOLID MANURE	5000 kg.	3500 kg.	100 kg.	100 kg.	250 kg.
Phosphoric acid	0.15 %	0.3 %	0.5 %	0.5 %	0.25 %

According to these data and on the basis of the live-stock census, Denmark has 50 053 metric tons of nitrogen, 84 749 of potash and 20 435 of phosphoric acid ; Norway 23 762 metric tons of nitrogen, 42 001 of potash and 10 261 of phosphoric acid ; Sweden 55 500 metric tons of nitrogen, 93 491 of potash and 25 592 of phosphoric acid.

The balance of the quantities of substances removed from the soil by crops and of those returned to the soil in the manure, is as follows (in metric tons) : —

	Denmark			Norway			Sweden		
	Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash
Crop	171 039	71 619	208 583	31 197	15 130	48 958	1 438 995	66 799	195 437
Manure	50 053	20 435	84 749	25 762	10 261	42 001	55 999	25 592	93 491
Deficit	120 986	51 184	123 834	7 435	4 869	6 957	1 383 396	41 207	101 946
as % of crop	71 %	71 %	60 %	23 %	33 %	14 %	96 %	62 %	52 %

The deficit in Norway is much less than in Sweden and in Denmark ; the reason for this will appear later.

The author also calculates the quantities of human urine and excreta which may add to the manure furnished by animals, thus increasing the available quantities of nitrogen, phosphoric acid and potash. He obtains the following figures : —

	Nitrogen	Phosphoric acid	Potash
	metric tons	metric tons	metric tons
Denmark	5 608	1 419	1 381
Norway	4 923	1 282	1 218
Sweden	11 084	2 900	2 771

The above figures, when added on to the amount of farmyard manure, slightly reduce the deficit, which thus comes down to the following proportions : —

	Nitrogen	Phosphoric acid	Potash
Denmark	67.5 %	69 %	59 %
Norway	8	24	12
Sweden	46	57	50

On account of her greater number of livestock and of inhabitants per unit of area of cultivated land, Norway is in the best position. In each case, however, the deficit is considerable, and if the soil-reserves continue to be drawn upon without compensating for the removal of fertilising material by means of sufficient quantities of chemical manures, exhaustion will eventually follow, with a rapid and continuous decrease in the total crop products.

Chemical Fertilisers. — These may be prepared in the countries themselves from raw material either from home origin or imported, or they may be imported ready-made from abroad. For the three countries and the three necessary elements under consideration, very different conditions are to be observed in this matter.

In *Denmark* nitrogenous manures of native origin are not produced, except for a small quantity of sulphate of ammonia, which in any case is almost all exported. Hence the quantity of manure used is represented only by the import figures. In 1914 there were imported : —

52 592 tons	nitrate of soda	with 15.5 %	nitrogen =	6 602 t.	of nitrogen
10 760 »	synthetic nitrogenous manures	with 13 %	» =	1 399	»
695 »	sulphate of ammonia	with 20 %	»	139	»
			Total	**8 140** t.	of nitrogen

Of phosphatic manures, the imports for the same year were : —

49 301 t.	phosphorites with about	30 % =	14 970	tons of phosphoric acid
142 883 t.	superphosphate with about	20 % =	28 572	» » » »
10 751 t.	basic slag with about	14 % =	1 551	» » » »
214 t.	bone ash with about	30 % =	641	» » » »
		Total	**45 734**	tons of phosphoric acid

Of potash, still during the same year, the imports were : —

8 385 t.	Kainit with	12 % =	1 006	tons of potash
15 284 t.	potash salts with	37 % =	5 565	» » »
		Total	**6 571**	tons of potash

For *Norway* in 1917 the data for nitrogen were : —

8 969 tons	nitrate of soda with	15 % =	1 435	tons of nitrogen
8 900 »	» lime with	13 %	1 157	» » »
2 800 »	cyanamide with	13 % =	364	» » »
		Total	**2 956**	tons of nitrogen

In 1917, there were also imported into Norway 37 431 tons of super-

phosphate (= 7 487 tons phosphoric acid), to which should be added 3 400 tons of superphosphate made in the country itself (= 529.4 tons phosphoric acid), or in all 8 016.4 tons of phosphoric acid.

In Norway, potash manures all come from abroad, making a total of 3 500 kilogrammes of potash contained in Stassfurt salt.

In *Sweden*, according to FEILITZEN, 7 108 tons of nitrogen, 35 866 of phosphoric acid and 2 232 of potash were imported as chemical manures, in 1914; in addition FEILITZEN estimates 29 484 tons of "poudrette".

GENERAL SUMMARY. — 1) The utilisation of atmospheric nitrogen, by means of the great water power available in the Scandinavian peninsula, is certainly one of the best ways of meeting the requirements of Scandinavian agriculture. With the half-million HP of the *A/S Norsk Hydro* Company, 40 000 tons of atmospheric nitrogen can be produced in the form of nitrate of lime.

TABLE IV. — *General Summary.*

	Nitrogen	Phosphoric acid	Potash
I. — *Denmark.*			
Crops	171 039	71 619	208 583
Manures of animal origin	55 661	21 824	86 130
Chemical manures	8 140	44 980	6 662
Total manures	**63 801**	**66 834**	**92 792**
Deficit (—) *or surplus* (+)	— **107 238**	— **47 85**	— **115 791**
Deficit or surplus as % of crops	— 63 %	— 7 %	— 56 %
II. — *Norway.*			
Crops	31 194	15 130	48 958
Manures of animal origin	28 685	11 543	43 219
Chemical manures	2 956	8 016	3 500
Total manures	**31 641**	**19 559**	**46 719**
Deficit (—) *or surplus* (+)	+ **447**	+ **4 429**	— **2 239**
Deficit or surplus as % of crops	+ 1 %	+ 29 %	— 5 %
III. — *Sweden.*			
Crops	143 895	66 799	195 437
Manures of animal origin	66 584	28 502	96 262
Chemical manures	7 108	35 866	22 324
Total manures	**73 692**	**64 368**	**118 586**
Deficit (—) *or surplus* (+)	— **70 203**	— **2 431**	— **76 851**
Deficit or surplus as % of crops	— 49 %	— 3 %	— 39 %

Again, the factories at Odda, in Hardanger, are capable of fixing 13 600 tons of nitrogen in the form of calcium cyanamide, while at present the Fysse and Aura falls are being harnessed, as well as the Bjalve rapids. which will furnish 360 000 H. P. capable of giving at least 108 000 tons of nitrogen.

In Norway a comparatively small quantity of nitrogen can be obtained (1 600 tons) from fish offal.

2) *Phosphoric acid.* — Cropping experiments carried out in different parts of Norway have shown that at any rate some soils need more phosphorus, so that it would be premature to state, without further examination, that this country does not require phosphatic manures, all the more so since the efficient use of animal waste is certainly below that theoretically allowed for in the calculation.

In Sweden and in Denmark the deficit in phosphoric acid is much smaller than that in nitrogen, although the atmosphere is an inexhaustible source of the latter substance, and the sources of phosphorus in these countries are of much less importance. Phosphatic minerals are present in small quantity, and it is only the full utilisation of fish offal (Norwegian fish guano contains almost the same quantity of phosphoric acid as of nitrogen) which could suffice to make good the shortage.

Hence for phosphatic manures Sweden and Dennark are forced to depend on imports.

3) *Potash.* — In respect of this element, Norway is also in the best position, whereas Sweden, and still more Dennark, show a very large deficit. It was hoped to meet the needs for potash by exploiting the felspars that are so plentiful in the Scandinavian peninsula, but so far no result has been obtained in this direction. Complete utilisation of ashes of all sorts could supply potash, but always in very limited quantity.

It should be further noted that, while in Germany 15 kg. of potash are applied per hectare, in Sweden, Norway and Denmark only 6 kg., 4 kg. and 26 kg., respectively, are applied, so that there are posibilities for much larger applications. Hence the importation of potassic material for manure is indispensable.

180 – **The Effects of Manuring on the Yield of Mountain Meadows and Grazing Land.** — Dusserre, C. (Head of the Federal Establishment of Agricultural Chemistry, Lausanne), in the *Annuaire agricole de la Suisse*, Year XX, No. 1, pp. 57-61. Lucerne, 1919.

According to the results of sales by public auction, the sale prices and rents of Alpine grazings have doubled and even tripled in the course of the last few years, in common with the value of the farm stock and its products. Landlords or tenants therefore have to try and get the best they can out of them, neglecting nothing that might increase the yield and quality of the pasture, such as the removal of stones, bushes or weeds, the complete and rational use of the manures made on the holding, etc. Many of these improvements maybe carried out with the labour available on the spot, and in their own interests proprietors and tenants should direct all their efforts to this end. Besides these improvements, the rational use of the commercial fertilisers on mountain meadows and pastures may render services similar

to those rendered for the crops in the plains and valleys. Thanks to the snow which covers the ground during a part of the year and hinders the decomposition of organic matter, the soil of mountain meadows and grazings is usually rich in humus and in nitrogen, so that the use of nitrogenous manures, which cost most, is not often necessary, and restitution may be confined to phosphatic, potash, and fairly often calcareous manures as well. On account of the solvent action on limestone of rain water and melted snow, the surface layer of the soil is often deprived of lime, as the subsoil is not brought up by ploughing ; this frequently happens in the Jura and limestone Alps. Manures containing lime help the decomposition of the humus and make the nitrogen available to growing plants. This explains the generally marked effect of basic slag, which supplies the soil with phosphoric acid and with lime, of which part is in the free state. As a consequence of the more scanty feeding of livestock, since the war began to diminish considerably the import of concentrated feeding-stuffs, cases of rickets and of troubles due to insufficient nourishment of stock are on the increase. Grass that has been treated with phosphatic and calcareous manures, and so is richer in nitrogenous material, phosphorus and lime, ensures better feeding, with a sufficient proportion of the mineral substances necessary for the formation and growth of bone.

Limestone and the soil derived from it is poor in potash compounds, so that potash salts are the best complement to phosphatic manures for it. The same effect can be got with wood ash ; the ashes from the household should be collected and used specially to manure parts of the pasture rich in humus, thus improving the frequently thin herbage.

The making of railways, highways and good mountain roads permits the transport of chemical manures for many pasture lands, and owners of Alpine pastures should profit thereby from all opportunities to cart concentrated chemical manures, to be sown in autumn or in spring as soon as the snow disappears.

Considering the present value of grazings and farm stock and its products, it is obviously necessary to increase the quantity and the quality of the fodder, thus providing for the maintenance of more and better fed stock. The objection that chemical manures would be damaging to the making of good cheese should not prove an obstacle, for, chosen judiciously and sown at the proper time, they cannot have any unfavourable effect on the quality of the milk and of its products.

In order to demonstrate the usefulness of commercial fertilisers on mountain meadows and grazing land, the Federal Establishment of Agricultural Chemistry of Lausanne has had experiments on hand for a long time which are kept up in different districts when circumstances make it worth while. Already the results of a certain number of these have been formulated ; they show that the manures when rationally applied eventually double the yield and, in addition, favour the growth of the good fodder plants (1).

(1) See *R.*, 1917, No. 917. (*Ed.*)

Other trials undertaken in the last few years, at the request of the interested parties, in different districts, show also the extent of the benefit to be derived from the use of chemical manures on mountain meadows and pastures. Thus, for example, on an Alpine pasture the transformation of the flora as a consequence of manuring is seen in the chemical composition of the fodder, which had the following content in crude protein : —

No manure	10.9 %
Superphosphate,	17.0
Superphosphate and potash salt	15.1
Superphosphate and liquid manure	12.0

Hence, not only the quantity but also the quality of the fodder is greatly improved by the different manurings carried out.

181 – **The Agricultural Value of Organic Manures.** — Russell, E. J. (Rothamsted Experimental Station), in *The Journal of the Board of Agriculture*, Vol. XXVI, No. 3, pp. 228-247, 1 fig. London. 1919.

Review of field experiments made in various places in England with different organic manures (rape cake, guano and shoddy) compared with nitrate of soda, sulphate of ammonia and with farmyard manure, to determine experimentally whether the higher price paid for those organic manures was justified beyond the measure of their content of fertilising elements (nitrogen, phosphoric acid and potash), in view of the fact that hitherto no well-defined field expriments had been made on the subject. From the experiments undertaken at Rothamsted (the most conclusive) with barley, wheat and mangolds, grown continuously on the same ground during 16 years, it appears that the nitrogen from rape cake in equal quantities is not so effective as that from nitrate of soda or sulphate of ammonia when these have been reasonably applied with sufficient quantities of phosphoric acid and potash. Further, rape cake has no residual effect on wheat or barley, while such effect is very marked, for at least 2 years, on mangolds; this is probably due to the strong growth of their leaves which were ploughed into the soil each year.

Rotation experiments also showed that rape cake had little appreciable effect after the year of application.

Experiments on light soils at Woburn also did not show any superiority of rape cake over mixtures of nitrate of soda and other chemical manures.

Comparing, on a basis of equal amounts of nitrogen, the respective effects of Peruvian guano, rape cake and shoddy during the year of application, the values were in the ratio 100 : 91 : 88, with the difference that shoddy had a certain residual effect.

The preference, shown for rape cake and guano is only explained by the fact that they constitute compound manures (rape cake : nitrogen 4.75 %, phosphoric acid 2 %; Peruvian guano : nitrogen 6 %, phosphoric acid 16 %, potash 2 %) capable of being applied without ill consequences even by inexperienced persons and in a single application, in large quantities (10 cwt to 1 ton per acre in the case of rape cake), where chemical manures would have to be applied in several relatively small doses to avoid

injury, especially to garden crops. Moreover, rape cake and guano are well adapted to the preparation of compound manures and facilitate their use with manure drills.

Although these various reasons may explain the higher prices fetched by rape cake and guano, compared with nitrate of soda and sulphate of ammonia according to their contents of useful elements, they do not, however, allow of valuing that difference in price on the ordinary unit basis. It has been suggested that unit value should be allowed for organic matter, but, according to the author, this would not solve the question since organic matter is not usually applied to the soil in sufficient quantity to exert any appreciable effect; the author is therefore of opinion that the best solution would be to leave prices of organic manures to be settled between seller and buyer, so that they would become in some measure prices of estimation and not quantitative prices (1).

182 – **Analysis of some Organic Manures.** — GUILLIN, R. (Report on the work done at the Laboratory of the French Farmers' Society in 1917 and 1918), in *Bulletin de la Société des Agriculteurs de France*, pp. 171-172. Paris, June, 1919.

During the war, all organic refuse, of small value in normal times and too often thrown away or inefficiently used, has been submitted, on account of the high cost of concentrated manures, to more thorough examination and utilised judiciously according to its composition. The following table shows the average content in fertilising substances of some kinds of refuse frequently used: —

	Nitrogen	Phosphoric acid	Potash
Horse dung	0.45 %	0.40 %	0.45 %
Pigeon droppings	2.75	2.50	1.50
Poultry "	1.10	1.15	0.95
Sheep "	1.80	0.60	2.00
Compost	0.60	0.75	0.70
Dry closet manure	0.60	0.55	0.30
do., desicated (poudrette)	0.90	3.00	0.20
Grape residues	0.75	0.25	0.65
Wine lees	3.50	1.40	8.00
Damaged grain	2.20	1.00	1.30
Damaged bran	2.40	2.30	1.40
Distillery grains	6.00	0.70	0.15
Soot	1.20	0.40	0.20

(1) In these accounts of the effect of organic manures on the soil it should not be overlooked that the author is considering the United Kingdom where the climate is moist and consequently very different from that of sub-humid, semi-dry and dry zones. (Ed).

183 – **Nitrogen Losses in Urine.** — Bear, F. E. and Royson, J. R. (Department of Agricultural Chemistry and Soils, Ohio State University, Columbus), in *Journal of the American Society of Agronomy*, Vol XI, No 8, No. 319-326, bibliography of 7 publications, Lancaster, Pa., 1919

More than half the nitrogen of farmyard manure is contained in the urine, hence the interest of the research undertaken by the authors on the losses of nitrogen in the urine of farm animals, more especially because many agriculturists usually keep the urine in tanks until the time when it is sprinkled on the fields. The expediency of keeping the liquid portion of the manure in this way having been much debated, the authors invetigated the losses of nitrogen from urine ; — (*a*) exposed to the open air ; (*b*) in Bunsen valve flasks ; (*c*) in closed flasks ; (*d*) in closed flasks but with the air replaced by carbon dioxide ; (*e*) absorbed in litter (replaced for the experiment by filter paper) ; (*f*) covered with a layer of kerosene. These experiments showed that urine exposed to the air lost over 92 % of its nitrogen in 8 weeks under temperatures averaging 38° C.; under temperatures averaging 5° less the same loss took place in 12 weeks. Urine not exposed to air lost on the other hand little or no nitrogen. Regarding the method of preventing loss of nitrogen by absorption in litter the effectiveness depends on the manipulation ; when the litter was allowed to dry there was a loss of 20 % of nitrogen, but when it was kept moist the loss was 97 %, the maximum observed in the different experiments. The use of kerosene for covering the urine is a good means of preventing loss of nitrogen, for in this case the losses were not greater than 6 % during 8 weeks.

184 – **The Phosphate Deposits in Switzerland and their Utilisation in Agriculture.** — Touninger, E. (Mitteilung aus der schweizerischen agrikulturchemischen Anstalt Bern), in *Landwirtschaftliches Jahrbuch der Schweiz*, Year XXXIII, No. 3, pp. 288-312. Lucerne, 1919.

Up till now no phosphate deposits have been discovered in Switzerland of sufficient importance to supply the country with all the phosphoric acid it needs. The only phosphorite beds of any extent are those in the gault at Buchs-Werdenberg in the canton of Saint Gall ; their contents are estimated at about 20 000 tons of phosphoric acid, but the thinness of the seams, the hardness of the material and many faults make it difficult to work them. Experiments in the preparation of superphosphate. (with sulphuric acid left after the manufacture of explosives or with bisulphate of soda) carried out with this material have not given at all satisfactory results, both on account of unfavourable conditions arising out of its chemical composition (about 10 % phosphoric acid) and on account of its physical texture.

With regard to the use of the natural Werdenberg phosphorite finely ground as a manure, trials made up to the present in the field and in pots under favourable conditions do not allow of a definite conclusion being arrived at.

185 – **The Palms of the Philippine Islands.** — BECCARI, O., in *The Philippine Journal of Science*, Vol. XIV, No 3, pp. 295-362, 2 pl. of 10 fig. Manila, March, 1919.

The species of palms at present known to be indigenous to the Philippines number about 120, not including a few semi-wild or cultivated forms. Of that number there are a dozen species of relatively wide geographical distribution, all the others being endemic forms. Among the non-endemic forms, some are derived from species growing in swamps or at the mouths of rivers, along the coasts of neighbouring countries, others have been introduced by man or other means.

The author, after giving a list of all the species and varieties of palms known in the Philippines, describes them botanically one by one.

186 – **The Grasses of Illinois, U. S. A.** — MOSHER, E., in *University of Illinois Agricultural Experiment Station, Bulletin*, No. 205, 425 pp., 285 figs., bibliography of 23 works (including only those which mention grasses of Illinois). Urbana, III, Mark, 1918.

This is a fully illustrated monograph on the grasses of Illinois dealing with structure of the grasses; key to the genera of Illinois grasses; brief description and observations on the grasses found in this State. A list and description is given of 204 species representing 63 genera; 43 species are listed in it for the first time as occuring in Illinois.

187 – ***Agave Cantula* Roxb. from the Botanical Point of View: Origin, Distinction from *Agave americana*, Synonomy.** — See No. 203 in this *Review*.

188 – **An Asclepiad of the genus *Araujia* Dangerous to the Insects that Ensure its Pollinisation.** — RICÔME H., in *Comptes rendus de la Société de Biologie*, Vol. LXXXII, No. 25, pp. 1045-1047. Paris, Oct. 18, 1919.

As is well known, in Asclepiads the cross fertilisation carried on by insects takes place owing to the fact that the retinacula adhere to the head of the insect, carry with them the pollen.

The author calls attention to a climbing asclepiad of the genus *Araujia*, grown in gardens, the pollen-bearing flowers which are visited by bees, winged ants and day and night moths such as the Sphinx hawk-moth.

In order to reach the nectar, the insect has to insert its proboscis between the stamens and corolla; then the proboscis is withdrawn easily, the retinacula trodden by the fore feet, adhere to the tarsis, and cross — pollination is assured. But often the insect inserts its proboscis, not outside the stamens, but between one of the retinacula and the contiguous borders of two adjacent anthers. The retinaculum has a viscous groove which closes on the proboscis and holds it, and the insect is captured and dies of starvation. Even vigorous insects like the bee and sphinx moth are powerless to free themselves, as the flower has a stamen and carpel arrangement such that the more the insect struggles the firmer the part of the proboscis caught is held between the anthers, as if in a vice.

In the author's opinion, considering the large number of insects captured, this plant should not be grown near places where bees are kept.

189 – **The Composition of Cereal Grains: Mistakes made in Locating the Chemical Constituents of Wheat and Rice Grains; Aleurone.** — G. VARESCHI, I., in *Annali della R. Accademia di Agricoltura di Torino*, Vol. LXI. pp. 3-31. Turin, 1918.

The author examines critically several of the commonest treatises on botany, showing their mistakes regarding the location and nature of the chemical constituents of wheat and rice grains. He makes out that several authors confuse between aleurone (a mixture of albuminoids not yet well defined and separated) and gluten (a mixture of at least 5 albuminoids, among which glutenin and gliadin, especially the latter, are typical), and he draws the following conclusions from his work: —

1) True gluten is found only in wheat and rye grains.

2) The albumen or kernel of wheat, rice and the other cereals contains not only starch but also always albuminoid material (gluten and non-gluten).

3) The gluten, whether previously formed or not, exists with the starch in the albumen and not in the so-called " aleurone " layer, and in much more minute quantities in the outer coats. In wheat-seed albumen, starch does not exist alone, but is always associated with gluten. The quantity of gluten increases from the middle towards the outside of the albumen; it has not yet been proved whether the gluten pre-exists in the albumen or is formed by the action of water.

With the following reagent: 1 gm. Hofmann violet + 50 gm water + 6 to 8 gm. sodium bisulphite + 9 to 10 cc. hydrochloric acid at 1.19, it is easy to recognise the albuminoid materials in flour.

4) It is easy to separate gluten from starch in wheat, but difficult to separate albumoid from starch in rice.

Rice contains glutenin, glutencasein, glutenfibrin, edestin or phytovitellin, but not gliadin, which is typical of true gluten. On the other hand, rye, like wheat, contains gliadin, glutenin and conglutin (which appears to be identical with edestin); it therefore contains a true gluten.

5) It is erroneous to state that aleurone is synonymous with gluten.

6) The term " aleurone " should be abolished, so as not to cause confusion, and replaced by the generic name " albuminous or protein matter ".

190 – **Seasonal Variations in the Chemical Composition of Seaweed.** — LAPIQUE, LOUIS, in *Comptes rendus de l'Academie des Sciences*, Vol. LXIX, No. 26, pp. 1426-1328. Paris, Dec. 29, 1919.

While pursuing studies on behalf of the Inventions Department (1), on seaweed as considered from the food point of view, the author found a considerable seasonal variation, affecting the value of these plants as raw material for several purposes. He took *Laminaria flexicaulis* as a typical marine alga. He found that from springtime onwards the cell sap became richer in laminarin and mannite, and became proportionately poorer in salts. It is easy to imagine that such is the result of the chlor-

(1) See *R.*, Feb., 1919, No. 225. (*Ed.*)

ophyl action in relation to light, of which the seasonal difference must be still greater under water than on land.

PLANT BREEDING

91 – **Behaviour of the Characters "Date of First Head", "Height of Plant" and "Width of Leaf" in certain Crosses between Hard, Medium and Soft Wheat in the United States.** — FREEMANN, GEO. F., in *Genetics*, Vol. IV, No. 1, pp. 1-93. Princeton, New Jersey, Jan., 1919.

Results of a long series of experimental researches on the transmission of the characters date of the first head, height of the plant and width of the leaves, in some hybrids between soft wheat and hard or medium wheat.

MATERIAL USED. — *Hard Algerian* (No. 1) : — late, tall; stems large, stiff ; leaves broad, medium width, dark green; heads large, long, slightly flattened ; glumes bearded, pubescent, light yellow ; grain large, translucent, very hard ; some grains have sometimes spots of opaque starch in the endosperm.

Red Algerian medium. — Late, tall ; stem medium sized ; leaves medium in width and colour (green but not very dark) ; heads medium sized, square ; glumes bearded, glabrous, light yellow ; grain red, medium hard opaque.

Early Baart. — Early, low ; stem medium sized ; leaves medium in width, green ; heads medium sized, square ; glumes bearded, glabrous, light yellow ; grain white, opaque, soft.

Sonora (No 35). — Early, low ; stem medium sized ; leaves broad, light green ; heads cylindrical, medium sized ; glumes beardless, pubescent, redd sh brown ; grain white, opaque, soft.

DATE OF THE FIRST HEAD. — *Hard Algerian* (No. 1) × *Sonora* (No. 35). — The average date of the first head of the parents and the hybrids in F_2 may be summed up as indicated in the following Table, where the number entered in the columns represent the *cultures*, or groups of plants originating from a single plant ; thus in the column March, 25-26 the number 7 signifies that this date is the average date of the first head for 7 distinct *cultures* of the F_2 generation.

	March							April			
	17–18	19–20	21–22	23–24	25–26	27–28	31–1	2–3	4–5	6–7	8–9
No 35	—	2	1	—	—	—	—	—	—	—	—
(1 × 35) F_2	—	—	—	1	7	17	12	—	—	—	—
No 1	—	—	—	—	—	1	4	1	2	1	—

The hybrids in the F_2 generation thus show themselves 3 days later than the earlier of the parents and 4 days earlier than the latest of the parents.

There were the following standard deviations (σ) of the whole population: No. 35 = 2.14; No. 1 = 3.30; (1 × 35) F_2 = 4.00.

For F_3 there were the following average dates : —

	March				April												
	25–26	27–28	29–30	31–1	2–3	4–5	6–7	8–9	10–11	12–13	14–15	16–17	18–19	20–21	22–23	24–25
No 35.	—	4	1	—	—	—	—	—	—	—	—	—	—	—	—	—
(1 × 35) F_3 . . .	3	2	4	6	8	13	17	21	33	58	38	8	13	3	3	—
No 1	—	—	—	—	—	—	—	—	—	2	3	2	—	—	—	—

The standard deviations of the whole population were : — No. 35 = 1.34; No. 1 = 1.99; (1 × 35) F_3 = 6.24. The high value of the deviations in the F_3 generation can only be explained as the effect of special climatic conditions. The author explains the phenomenon in the following manner : — from one generation to the next the number of homozygotes tends to increase, while the number of heterozygotes decreases and they tend to take an intermediate position (in approaching the average value), hence there results, as a natural consequence, an increase in the extreme values.

Among the hybrids in F_3 three cultures were earlier than No. 35 (the earlier of the parents) and 19 were earlier than No. 1 (the later of the parents) Would it then be possible by recombination of the characters to isolate races earlier or later than the parents themselves ? Before answering such a question the results of another cross *Red Algerian medium* (No 3) × *Early Baart* (No. 34) should be examined. So far as the average dates of the first head in F_2 and F_3 are concerned, much the same results as in the previous case were recorded : the hybrids tend to take an intermediate position with respect to the parents and the standard deviation increased largely from the F_2 to the F_3 generation as effect of the decrease in heterozygosity. The following Table illustrates this point.

	March						April						
	21–22	23–24	25–26	27–28	29–30	31–1	2–3	4–5	6–7	8–9	10–11	12–13	14–15
No 3 . . .	—	—	—	—	—	—	—	—	—	—	—	3	2
(3 × 34) F_3	—	—	1	12	9	14	15	21	9	6	10	7	8
No 34. . .	1	1	2	1	—	—	—	—	—	—	—	—	—

The means of the hybrid cultures all fall within the mean limits of the parents. In this case recombination of characters has not brought about the appearance of new types superior in earliness or lateness to the parents (contrary to what appeared to exist in the previous case).

According to the Mendelian theory. the plants of the F_2 generation having a closer relationship with the hybrids of F_1 (heterozygotes in the

highest degree) ought, in F_3, to produce much more variable descendants (for the greatest possible number of combinations) than the hybrids of F_2 with a genetic constitution further removed (greater homozygosity) from that of the plants of the F_1 generation. That this has not taken place in many cases is due to the fact that many combinations theoretically expected are, in pratice, incapable of growth or sterile, so that the variation curve corresponds only to part of the descendants.

The phenomena observed can be explained by the existence of at least 3 factors governing the date of the first head. No attempt has been made to determine the number of factors acting in each case but the fact that many of the groups with intermediate characters show cultures with low variability would indicate that the number of factors concerned was very high, thus making it possible to obtain some types genetically different but still homozygous.

HEIGHT OF THE PLANTS. — The material for examination in this enquiry came from 4 crosses :— *Hard Algerian* (No. 1) × *Sonora* (No. 35) ; *Hard Algerian* (No. 1) × *Red Algerian medium* (No. 3) ; *RedAlgerian medium* (No. 3) ×*Sonora* (No. 35) ; *Red Algerian medium* (No. 3) × *Early Baart* (No. 34).

The examination of the plants in F_2 and F_3 gives the impression, so far as the character " height " is concerned, of two antagonistic forces : — (1) heterozygosis, which causes the plants in F_3 derived from hybrids of F_2 to resemble the hybrid of F_1 (that is to say of F_2 with the greater number of pairs of characters in the heterozygous state), much more variable than those descending from the hybrids of F_2 where the homozygous pairs prevail ; (2) another force which tends to suppress variability in the *tallest* cultures.

Admitting that all the plants in F_1 were genetically equivalent, the descendents in F_2 of the several cultures ought to have the same averages and the same coefficient of variability in all cases, as can be seen from the adjoining Table :—

An examination of these data shows that the variability in the tall classes is less than in the low classes, but the differences, though small, are constant and indicate the presence of a factor suppressing the variability even of the taller cultures. The presence of this suppression factor is still more clearly indicated in the cultures of the various parents taken separately :—

Having thus proved the existence of a factor which may reduce the variability of the taller cultures, independently of heterozygous condition, the observed facts may be explained as follows (1) : This factor has completely masked the effect of heterozygosity in the cross 3 × 34, in which the F_2 and F_3 cultures had an average height greater than that of the taller parent.

(2) This factor has partly suppressed, but not completely masked, the variability due to heterozygous conditions in the cross 3 × 35, in which the F_2 and F_3 cultures were approximately as tall as the taller parent.

(3) The effect of this factor is still evident in the crosses in which the F_2 and F_3 cultures showed heights less than those of the parents

		Average heights in cm. (1915)					
		100–109	110–119	120–129	130–139	140–149	150–159
(1 × 35) F_2	Number of cultures	—	4	30	4	—	—
	Average coefficient of variability	—	19.2	19	18.9	—	—
(1 × 3) F_2	Number of cultures	2	1	1	1	1	—
	Average coefficient of variability	28.5	20.2	10.4	14.5	—	—
(3 × 34) F_2	Number of cultures	—	—	—	—	2	4
	Average coefficient of variability	—	—	—	—	5.5	4.8
(3 × 35) F_2	Number of cultures	—	—	—	1	9	8
	Average coefficient of variability	—	—	—	7.0	5.9	6.0

		Average heights in cm.				
		110–119	120–129	130–139	140–149	150–159
No 1	Number of cultures	—	2	4	6	4
	Average coefficient of variability	—	7.5	7.5	6.5	5.
No 35	Number of cultures	3	3	1	1	—
	Average coefficient of variability	6.7	6.7	6.4	3.9	—
No 3	Number of cultures	—	2	3	1	—
	Average coefficient of variability	—	7.5	5.6	4.2	—
No 54	Number of cultures	1	4	1	—	—
	Average coefficient of variability	6.9	6.1	4.8	—	—

without being, however, sufficiently intense to mask the effect of heterozy gosity. Having thus defined the disturbing action of the factor suppressin variability, all the other facts can be, are very simply explained on th hypothesis of the segregation and recombination of a certain number simple Mendelian unit characters.

WIDTH OF LEAF. — For this character also, as in the case of height, facts were observed which can only be explained on the hypothesis of the existence of a factor which, in spite of heterozygous conditions, tends to suppress the variability of cultures with very wide leaves. In these cultures, the coefficient of variability is less than in cultures with narrow leaves.

Three questions suggest themselves:—

(1) Can it be that the coefficient of variability is not a proper measure for the exact determination of the variability of quantitative characters in biology?

(2) Can it be that even the purest lines of wheat are partly heterozygous and that among them the lines which are tall and with wide leaves are more homozygous than the others?

(3) Can there, perhaps, be some physiological limitation of growth in the higher (wider) classes which prevents the full development and expression of certain over-complicated recombinations of characters?

The author inclines in that case to (1) and (3). If a car is moving at a speed A and an additional force $F + m$ is applied which produces a speed $A + n$; to produce a speed of $A + 2n$, a force greater than $F + 2m$ would be required. The effect of a factor (environ mental or genetic) for increasing size becomes attenuated, it would seem, in combinations which tend to produce values higher than the general average of the race. And vice versa the action of the same factor would be more strongly marked in gametic combinations which tended to produce values lower than the average value of the race. It is possible, therefore, that the variability of quantitative characters may be better measured by the coefficient derived by dividing the standard deviation by some fractional power of the mean:—

$C_1 = \frac{\sigma}{M^x}$, where x is a quantity less than 1.

So far as other factors are concerned in the case of width of leaf, as in the case of height of the plant, the observed facts can be explained in accordance with Mendelian laws by the segregation and recombination of the characters. These factors, wich are certainly numerous, have not yet been determined.

192 – **New Types of Wheat, Rye and Oats obtained by Hybridisation and Selection at Svalof, Sweden.** — NILSSON, N. HJALMAR, in *Sveriges Utsädefärenings Tidskrift*, Year XXIV, No. 3, pp. 116-117. Malmo, 1919.

"203, *Birgitta*, 086" is a new kind of wheat obtained by crossing Smaahvede and Extra Squarehead II. From comparative cropping tests carried out in Östergötland it was found to be superior to Sol II in grain yield; it is much more resistant to attacks of the rhynchote *Cicadula* (*Jassus*) *sexnotata* (1). In earliness it shows itself equal to the Sol variety, and is a type of wheat especially suited to the fertile land in the Östgöta plain.

(1) See *R.*, June 1915, No. 648. (*Ed.*)

" 204, 0955 ". This variety of wheat, the result of the cross Pansar × Fylgia, is destined to replace the Fylgia variety, to which it is plainly superior in its greater resistance to the rigours of winter and to rust and in the greater strength of its straw. It ripens earlier than the Pansar variety, and at the same time as Fylgia wheat.

" 205, *Stål*, 0302 ", is a new variety of rye obtained as a pure line (by genealogical selection) from the Stiärn varieity, from which it is distinguished by its rather shorter and more robust straw, but it remains equal to the original variety both in quality of grain and in yield.

" 209, 01180, *b* " is a new variety of oats obtained from the cross Seger × Kron, destined to replace the Kron variety.

" 210, 01171, *b* " is a new variety of oats from the cross Seger × Gul Naesgaard and is destined to replace the Seger variety.

193 – **Observations on the Heredity of Characters in the Lupin, Wheat and Barley, in Denmark.** — VESTERGAARD, H. A. B., in *Tidskrift for Planteavl*, Vol. XXVI, No. 3, pp. 491-510 + 7 figs. Copenhagen, 1919.

LUPIN. — *Colour of flowers.* — *Lupinus angustifolius* generally has blue flowers, but some individuals have red and others white flowers.

These 3 types keep constant and separate in their progeny, cases of cross pollination by insects being very rare.

By crossing plants white flowers (♀) with plants with blue flowers (♂), in the F_1 blue individuals were obtained, and in the F_2 blue individuals and white individuals in the simple Mendelian ratio 3 : 1, as if the difference between the two types were due to the presence of a blue, factor dominant compared with its absence.

The author next made the cross *white* ♀ × *red* ♂. In the F_1 he obtained hybrids with white flowers instead of red as would have been expected on the basis of a simple factor. The F_2 was composed of specimens with blue, red and white flowers, respectively, in the proportion 9 : 3 : 4. The phenomenon may be explained by allowing that, in order to produce the blue, not a single factor is necessary, but two, **B** and **R**.

In the presence of the single factor **B**, the flowers remain white, while in presence of **R** only, they take on a red tint.

In the case studied, the white type therefore should have the genetic constitution **BBrr**, and the red type the constitution **bbRR**, from which in the F_2 the formula **BbRr** (with blue flowers) is obtained. Such a hybrid produces 4 kinds of gametes : — **BR, Br, Rb,** and **br**, which, when combined with one another, give 16 possible combinations in the F_2, namely : —

1 **BB RR** + 2 **BB R r** + 2 **B b RR** + 4 **B b R** *r* . . = 9 *blues*
1 **bb RR** + 2 **bb R r** . . . . . = 3 *reds*
1 **BB rr** + 2 **B b r r** + 1 *bb* **rr** . . . . . = 4 *whites*

The crosses *red* × *white* were also made and results obtained which are quite explicable on the basis of the above scheme : the F_2 is composed of plants with blue and red flowers respectively in the proportion 3 : 1.

WHEAT. — *Appearance of loose-eared plants in pure varieties of compact-eared wheat.* — Starting point: — 40 pure varieties of " Abed " wheat with close ears (1914). In one of these lines, composed of about 50 plants with typically compact ears, a specimen with loose elongated ears was picked out.

From this plant, in 1915, there were derived 27 compact-eared and 27 loose eared plants, each lot clearly separate from the other. The former had 2 stems per plant, the latter 14 stems, that is, a lower tillering along with greater length in the stems ; consequently the latter were less robust.

The following table shows the differences observed between the two types :

	Compact-eared type	Loose-eared type
Number of stems per plant	2.0 — 2.2	1.4 — 1.6
Height of stems. cm.	127	135
Length of ear. cm.	8.26	9.50
Number of spikelets	19.3	18.0
Average distance belween two spikelets mm.	4.3	5.3

Of each of these types, 10 pure lines were sown. The 10 lines derived from the compact-eared type gave, in 1916, compact-eared plants, while the 10 lines derived from the abnormal type gave a mixed progeny of compact-eared and loose-eared plants.

In 1917, the same phenomena were repeated ; in no case were constant loose-eared pure lines obtained.

In 1918, in a culture, besides the two loose-eared and compact-eared types there appeared also a third type with short stems and very short and compact-ears, which greatly resembled " Kubbe " wheat (*Triticum compactum*).

This 3rd type, represented by a single specimen, in 1919 gave a progeny including, besides the 3 above-mentioned types, also a 4th type, which was dwarf.

BARLEY. — *Crossing dwarf forms and normal forms.* — In 1915 the author crossed " Binder " barley with a dwarf barley derived from the mutation of a pure line of 2-row barley.

In the F_1 the hybrids resembled the " Binder " parents ; the F_2 contained normal and dwarf plants respectively in the very doubtful proportion 6 : 1.

Transmission of abnormal characters. — Plants having giant ears, mostly empty and misshapen, which were isolated in 1916, gave in 1917 a progeny composed of 36 abnormal and 4 normal specimens.

In 1918, the seed of 10 of the 36 abnormal and of 2 of the 4 normal specimens was sown, and there were obtained, in the former case, exclusively abnormal progeny, and in the latter case mixed progeny: No. 1 = 35 normal + 8 abnormal, and No. 2 = 22 normal + 8 abnormal, that is, in all, 57 normal and 16 abnormal, in the proportion 3.35 : 1.

Hence this anomaly is a recessive property with respect to the dominant normal form.

The two plants of normal aspect were, therefore, of hybrid nature, and also the mutant of 1915 must have been, from which in 1916 there were derived the plants in which the anomaly was visible.

194 - **The Selection of *Hevea brasiliensis* according to Individual Difference in Yield.** — I. WHITBY, STAFFORD, in *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, No. 8, pp. 317-318. London, 1919. — II. MASS, J. G., in *Mededeelingen van Algemeen Proefstation der A. V. R. O. S., Rubberserie* No. 21, pp. 1-20. Medan, August, 1919.

I. — These are the results of a series of observations made in the Federated Malay States on the specific differences in the amount of rubber yielded by individual trees of *Hevea brasiliensis* of the same age and growing under the same conditions, in order to establish also whether there exists a correlation between the yield and the girth of the trunk. Some 1000 trees, 7 years old, in a normal plantation covering 13 acres, were carefully studied, the trees being in their third year of tapping.

Great variations were found in the rubber content of the latex (the "strength" of the latex) from different trees, and appeared to be constant from year to year. Some trees yielded 23 gm. of rubber per 100 c.c. of latex, others as much as 54 to 55 gm. per 100 c.c. of latex, the mean for the 245 trees examined being 39.58 gm. per 100 c.c.

The rubber content of the latex increases as the trees grow older, to the extent of 1-2 per cent. per annum.

The author admits the possibility of obtaining good positive results from selection based entirely on individual variations : if high-yielding trees can be segregated and provided that pollen of poor-yielding trees can be prevented from gaining access to the flowers, it should be possible to get seeds capable of producing trees with a high percentage of rubber in the latex. There is a definite correlation between girth and yield, but it is not sufficiently well indicated to be of great value in eliminating trees from a plantation.

II. — In Hevea plantations there are good and bad yielding trees. For 5000 trees 8-9 years old, the mean daily yield of latex was 22 c.c. Eighty per cent. of these trees gave on the average ± 10 c.c., while the remaining twenty % alone produced 65% of the entire yield. It is to be inferred from these results that productivity is a hereditary character.

On the other hand, in plantations, free cross-pollination mixes good and bad elements in the most varied of genetic combinations, while complete segregation of the best specimens involves very great difficulty from the technical and practical point of view.

The author urges the suitability of vegetative propagation of the best yielding trees, by grafting on to the young plants slips from specimens that have been under careful and continuous control and are notable for their high yielding properties.

It is a case of repeating with *Hevea brasiliensis* that which is being

tried at present with coffee and cacao in Suriman and has already been carried out on a large scale in the United States citrus plantations.

195 – **Apple Bud Selection and Selection of Apple Seed for the Propagation of Apple Seed.** — CRANDALL, CHARLES S., in *University of Illinois Agricultural Experiment Station, Bulletin* No. 211, p. 180-264, 42 fig. Urbana, Illinois, June, 1918.

Results of a series of experiments made since 1907 with the object of establishing : —

(*A*) Whether, when selecting apple buds, account should be taken of the size of the buds and of their position on the tree and on the branch.

(*B*) Whether apple seedlings obtained from seed taken from large apples are better than those produced by seed taken from small apples.

(*A*) SELECTION OF THE BUDS. — (1) *Large buds and small buds.* — For estimating the effect of selection of the bud, the annual growth of the plants (produced from the buds) was measured in inches. The following Table sums up the principal data : —

Variety of Apple	Size of bud	Average growth in inches							
		1908	1909	1910	1911	1912	1913	1914	1915
Yellow transparent	Large	21	11	11	37	40	53	74	92
	Small	17	6	9	42	50	60	72	93
Oldenburg	Large	15	26	11	46	49	63	70	92
	Small	11	20	12	37	45	58	72	93
Grimes	Large	19	20	9	42	51	64	80	102
	Small	21	16	8	38	47	53	64	90
Winesap	Large	28	17	9	46	55	70	88	116
	Small	21	10	11	46	56	72	89	113
Ben Davis	Large	28	19	9	43	52	64	78	98
	Small	20	21	7	46	56	69	84	109

Note. — Total growth (leader and branches) is given for 1908 and 1909; growth of leader only for 1910 ; total height of the plant for each succeeding year.

As an examination of these data proves, there is nothing in them, at least so far as vigour of growth is concerned, that points to any difference due to the size of the buds for grafting.

(2) *Position of the bud on the tree.* — The buds for propagation were divided into 4 classes for this purpose : —

(*a*) Terminal buds from central terminal shoots.

(*b*) Terminal buds from extreme lateral shoots on the south side of the tree (in full exposure to the sun).

(*c*) Terminal buds from extreme lateral shoots on the north side of the tree and for the most part shaded.

(*d*) Terminal buds from short interior branches.

(*e*) Terminal buds or scions from centrally located water sprouts.

In this case, as in the former, the selection of the buds had no influence on the subsequent growth. The growth curves are essentially the same for *a*, *b*, *c*, *d*, and *e*.

(3) *Position of the bud on the shoot.* — For this purpose the selected buds were divided into 4 classes: —

(*a*) Terminal buds.
(*b*) Lateral buds from the top extremity of the shoot.
(*c*) Buds from the middle of the shoot.
(*d*) Buds from near the base of the shoot.

From the data collected in tabular form and also in graphs no relation is shown to exist between the position of the bud on the shoot and vigour in growth.

Conclusion. — The size and the position of the bud do not give any indication to help selection.

(*B*) SELECTION OF SEED. — The fruit was classed as "large" and "small" on a basis of the size; all fruits having transverse diameters of 65 mm. or more were classed "large" and those having transverse diameters of 64 mm. or less were classed "small". The following Table relates to the varieties Grimes and Jonathan: —

	Grimes		Jonathan	
	Large	Small	Large	Small
Average weight . . . . . gm.	130.70	106.31	141.46	93.83
Average transverse diameter . . mm.	66.00	62.00	70.91	60.59
Average longitudinal diameter . mm.	57.00	—	60.31	52.26

From the many data collected regarding the vigour of growth of the plants, it appears that plants grown from seed taken from large apples are more vigorous and resistant to disease and adverse conditions than those grown from seed taken from small apples.

CULTURAL SEEDS

196 – **The Activity of the "Federazione dei Consorzi Agrari Italiani" for the Production of Pure Seeds in Italy.** — *Giornale di Agricoltura della Domenica*, Year XXIX-No. 33, p. 238. Piacenza, August 17 1919.

In 1918. the "Federazione dei Consorzi agrari" (Federation of the agricultural consortia) initiated a programme which consisted essentially of the following two points: — 1) to encourage adaptation tests, in different regions, of selected varieties from the plant-breeding stations; 2) to encourage the industrial production of seeds, both by farmers and by their associations.

For the purpose of the adaptation tests, in 1918 about 350 quintals of wheat seed were got, of the best pure varieties obtained by M. TODARO, of the Bologna Plant-breeding Station, by M. STRAMPELLI, of the Rieti Station, and by M. PASSERINI of the Scandicci Institute. These seeds were distributed to some of the principal agricultural associations for experimental

trials. The aim of the trials was to ascertain the ability of the varieties to become acclimatised to the different conditions and different parts of the country, and to compare each of them with the original non-pure variety Four varieties segregated at the Bologna Station, of the types *Gentile* (family 48), *Colognese* (families 12 and 10), *Inallettabile* (fam. 38) and *Marzuolo* (fam. 83), as well as *Carlotta Strampelli* (obtained at the Rieti Station) and the hybrid *Noé* × *Gentil rosso*, were reserved for north Italy and part of central Italy. In south Italy (province of Lecce) experiments were carried out with the varieties of wheat known as *Luigia Strampelli, Apulia, Dauno, Nuovo Gargano, Selezionato Maiorca*, and also *Maraini* barley from the Rieti Station. There were 38 centres for adaptation tests, with a total of 106 plots. The plots were inspected from the second week of May up to July 8 to 10. These tests provided the first material which the Federation will make use of in order eventually to set up model centres for the production of the best varieties of seeds.

CEREAL AND PULSE CROPS

197 - **Investigations on Wheat Siftings.** — Savini, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. 32, Nos. 7-9, pp. 361-374. Modena, 1919.

The paper deals with the work done at the central chemical laboratory of the Customs and Direct Contributions Department in Rome on wheat of different origins : various districts of Italy, Rumania, Russia, Argentina, Australia, British India, Morocco and North America. In all, 35 samples of soft wheats and 14 of hard wheats (the latter being mostly of Russian origin) from the 1913 and 1914 crops were examined. It could be taken for certain that none of the samples examined had undergone any cleaning process after threshing.

Conclusions. — The commonest seeds found in wheat siftings are, in alphabetical order : *Agrostemma Githago, Avena sativa, A. fatua, Convolvulus arvensis, Galium tricorne, Gladiolus segetum, Hordeum vulgare, Lolium temulentum, L. perenne, Lathyrus aphaca, Polygonum convolvulus, Saponaria vaccaria, Secale cereale, Sinapis arvensis, Vicia sativa, V. villosa, V. sylvatica.*

Less common, are seeds of : — *Adonis aestwalis, Bifora radians, Bupleurum protractum, Coronilla varia, Eroum ervilia, Lithospermum arvense, Medicago sativa, Melilotus sulcata, Muscari botryoides, Ornithogalum umbellatum, Rapistrum rugosum.*

Still less common are seeds of : — *Bromus secalinus, Camelina sativa Caucalis daucoides, Cirsium arvense, Centaurea Cyanus, Lolium italicum, Phalaris canariensis, Ranunculus arvensis, Scandix PectenVeneris, Setaria glauca, Sinapis nigra*, etc.

Out of 35 samples of hard wheats and 14 of soft wheats examined, only 3 contained, in very slight proportions, seeds of *Melampyrum arvense*, which are poisonous.

A large part of the commonest seeds is cosmopolitan, such as *Avena sativa, Agrostemma Githago, Convolvulus arvensis, Galium tricorne, Lathyrus aphaca, Sinapis arvensis, Polygonum Convolvulus*, etc.

Others are found only in Italian wheats, such as : — *Alopecurus*

agrestis, Bifora radians, Bupleurum protractum, Gladiolus segetum, Phalaris canariensis,

The following seeds are almost entirely absent from Italian wheats and are found mostly in foreign wheats : — *Camelina sativa-Saponaria Vaccaria, Setaria glauca, Sinapis nigra,* etc. Seeds of *Alopecurus agrestis* were found only, and then in abundance, in 5 samples from the district of Rieti (Italy).

Rumanian wheat is almost always notable for the large quantity of rye and corn-cockle found in it, and Russian soft and hard wheat for the presence of barley, *Polygonum Convolvulus* and *Saponaria vaccaria.*

As regards total percentage, the siftings oscillate between a maximum of 75 gm. per kg. (Moroccan wheat) and a minimum of 2 gm. per kg. (British Indian wheat). On the average, Italian wheat contain not more than 2 % and foreign wheats not more than 3 % of siftings.

198 – **Rice-Growing in Greece.** — PAPAGEORGIOU, P. (Director of the Royal Greek Society of Agriculture), in *Annales de Gembloux,* Year XXV, No. 3, pp. 93-97. Brussels, 1919.

Rice is not an important crop in Greece, but it is nevertheless true that rice is a paying crop where soil conditions (nature and exposure of the land) and water supply (springs, streamlets, etc.) are suitable, and in any case a duty of 24.65 francs per 100 *okes* (125 kg.) on imported rice favours home production. Some years ago, rice crops were of greater area in Greece than at present, because low-lying and marshy ground was then cultivated. Following on the State prohibition of this crop in places where there was stagnant water, with the object of diminishing the causes of malarial fever, rice cultivation had to be limited to healthy and irrigated ground. Thus, as regards the ancient kingdom, the crop is grown almost entirely in Thessaly ; according to the statistical data, the area cultivated is only 132.5 hectares, of which $^9/_{10}$ belongs to the Trikkala estates, which are provided with very efficient industrial machinery for treating rice.

As for New Greece, it is in Epirus mostly and in Macedonia that rice is grown. In Epirus, the province of Paramythis produces 312 500 kg. per annum and that of Margation 875 000 kg. In Macedonia the chief rice-growing districts are Vodena (112 500 kg.), Karatzova (62 500 kg.) and Yannitza (25 000 kg.).

Sowing is carried out in spring, when the temperature rises, the ground being previously well worked, ploughed, levelled and cleared of weeds. Planks set on slight earthen dykes divide up the rice fields ; the arrangement of the channels ensures irrigation at will according to needs, and at the same time the ground is kept wholesome. It is usual to sow 125 to 187 kg. of seed per hectare, less in the ancient kingdom, more in Epirus and in Macedonia (New Greece). The seed is covered in by means of a plank drawn by animals over the flooded ground ; the soil is kept constantly moist. Hoeing is diligently pushed on, so as to ensure uniform and vigorous growth. Reaping is done by sickle, in July, August and even in September, according to the district and the variety cultivated. The yield is variable : on the average, from 12 500 to 15 625 kg. per hectare. In Thessaly, rice is followed by

a wheat, cotton or maize crop, and is grown again on the same ground after an interval of 3 or 4 years. The native varieties are distinguished as white rice (" aspro ") and red-brown rice (" kokino "). The former of these is the better in quality, earlier and less productive ; the latter is a better yielder but is late. Spanish and Italian varieties have given very good results in Thessaly.

According to analyses carried out at the State agricultural chemistry laboratory at Athens, the composition of Greek rice, compared with that of other foreign-grown rice (Bombay, Japan, Burma) is as follows : —

Substances estimated	Grown in Greece			Bombay rice	Japanese rice	Burma rice
	Spanish variety of rice	Italian variety of rice (Ostigliese)	Epirus rice			
Water.	13.02 %	12.71 %	12.34 %	13.00 %	14.48 %	13.20 %
Starch and sugar . .	77.23	76.61	76.30	77.63	70.83	74.10
Nitrogenous matter .	7.50	9.04	9.95	7.44	10.47	9.26
Fats	0.42	0.36	0.56	0.70	2.39	2.20
Cellulose	0.76	0.33	0.38	0.80	0.80	0.60
Ash.	1.07	0.95	0.47	1.23	0.91	0.70
	100.00	100.00	100.00	100.00	100.00	100.00

This table shows that the kinds of rice grown in Greece are relatively very rich in starchy matter and that, among them, the varieties of Spanish origin acclimatised to the country take the lead.

Greece, a small producer but a large consumer of rice, imports annually 5 000 000 to 5 625 000 kg. The following are details of imports from 1901 to 1912 into the old kingdom of Greece : —

1901	4 562 864 kg.
1910	5 509 929 »
1911	5 599 256 »
1912	5 397 150 »

Imported rice comes from various foreign countries and several varieties are found in trade. Compared with these the locally-grown product is of inferior quality, chiefly due to the lack of suitable industrial treatment (polishing, glazing, etc.), the only exception being Thessalian rice which is worked up in a first-class mill.

Though rice-growing in Greece is at present of so little importance, suitable conditions, especially in the new kingdom, open up for it a future not to be despised ; in fact, besides certain parts of the old kingdom, Epirus and Macedonia (Yannitza, Vodena Vally of Axios, Karatzova, etc.) contain suitable land and plentiful water supply.

Everything considered, the development of rice cultivation in Greece will follow the general agricultural progress of the country, particularly in the new kingdom. Hence the desired progress, which will soon provide Greek farmers with new resources and national economics with new re-

venue, is to be expected from the efforts and propaganda of the Greek government and, in its own special sphere from the Royal Agricultural Society.

199 – **A Study on Rice from the Cameroons.** — HEIM and HUSSON, in *Ministère des Colonies, Bulletin de l'Agence Generale des Colonies* (formerly *Bulletin de l'Office Colonial*) Year XII, No. 142, pp. 569-574. Paris-Melun, Oct., 1919.

The General Commissioner for France in the Cameroons sent to the " Office colonial ", through the efforts of M. ROUGET, Delegate for French Equatorial Africa, varieties of Cameroon rice, which were referred for analysis to the Colonial Products Study Department.

The study of 3 varieties of the rice gave the results summarised in the present note. Two varieties came from the sub-division of Yoko and are named " Yoko No. 1 " and " Yoko No. 2 " ; one variety was from the sub-division of Duala.

The authors give the detailed results of their analyses.

Of all cereals, rice is the one which contains most starch and least nitrogenous matter. With rice intended for starch-making, preference should be given to kinds especially rich in starch and, consequently, poor in nitrogen. This no longer holds good where the rice is for human or animal consumption, or for distilling or brewing. Hence the content of nitrogenous matter in particular should be taken into account. From this same point of view it should be noted that de-germing the grain is an operation which causes a diminution in the food value of the rice.

The varieties Yoko No. 1 and No. 2 are very rich in nitrogen. Their content is even higher than that indicated by BALLAND for Saigon rice, which was the richest in nitrogenous matter of the commercial sorts (decorticated grains) analysed by him. Yoko No. 1 contains 8.44 % nitrogen and Yoko No. 28.75 % whereas in Saigon varieties, according to BALLAND, the percentage varies from 6.90 to 8.38. Hence these two types are perfectly suitable for distilling and brewing.

The above statement applies equally to Duala rice ; the nitrogen content of the decorticated grain exceeds the maximum given by BALLAND, for Saigon rice : 9.31 % for the entire and 8.57 % for the decorticated grain. On comparing the content in nitrogenous matter of Duala whole rice with that of the varieties studied by BUSSY (decorticated rice), this content is seen to be lower than in certain Far-East varieties (mountain paddy of Rais in the Lang-Bian region in Annam, Java rice, " Carolina " variety, Phu-My crop, etc.), and higher than in other varieties of the same origin (South Annam (Nhatrang) red-grain paddy). It may be admitted that this rice is similar to the Far-East varieties in composition.

CARCH CROPS

200 – **" La Succulente ", a New Variety of Potato Suitable for the South of France.** — ZACHAREWICZ (Director of the Agricultural Services of Vaucluse), in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, T. V, No. 36, p. 927. Paris, Nov. 26 1919.

This paper describes experiments in growing in Vaucluse a new variety of potato, " La Succulente ", coming from the north of France.

Planting was carried out on March 15 on a clay loam soil moderately rich in nitrogen and potash but poor in phosphoric acid, cultivated to a depth of 40 cm. after the application of 30 000 kg. of manure per hectare. Growth was regular and the harvest, on June 24, gave 18 000 kg. per hectare, while the variety known as " Institut de Beauvais ", cropped under the same conditions yielded only 16 000 kg.

This new variety, considering its yield, the quality of its tubers and its earliness, will be of great value in the South of France.

201 – **Potato Growing in the United States.** — HOLMES, G. K., in *U. S. Department of Agriculture, Bulletin No.* 695, 24 pp. Washington, Oct. 16, 1918.

These data are for the use both of the public in general and of those specially interested in the production, trade and consumption of foodstuffs, and include many statistics on : — area under potatoes in the United States, production, imports, supplies, exports from one State of the Union to another, supplies for export abroad, consumption per inhabitant since 1849, summary for the period 1905-1914.

In the last period, which reflects pre-war conditions, 343 394 000 bushels of potatoes were harvested annually from 3451000 acres, with an average production of 97.0 bushels per acre, or 3.76 bushels per capita and 99.1 % of the supply. The average price paid at the farm for potatoes was 59.1 cents per bushel.

202 – **The Use of Johnson grass (*Sorghum halepenes*) in Italy.** — PANTANELLI, E., in *Le stazioni sperimentali agrarie italiane*, Vol. 52, No. 7-9, pp. 405-415, Bibliography of 25 works. Modena, 1919.

FORAGE-CROPS MEADOWS AND PASTURES

The " canarecchia " or " sorgagna " (Johnson grass) is a Gramineae that grows wild round the Mediterranean basin, from which it passes to Persia and on to India In Italy it is common on the alluvial soils of the lower valley of the Po, in the Valdarno, lower Tiber, etc. ; it is always present on sandy places generally and on light soils ; in vine growing districts it is common on sandy soils (e. g. in the Etna region in Sicily).

This plant does not appear to be cultivated in Europe, where it is even regarded as one of the worst kinds of weeds ; in fact, it is very difficult to root out, because it multiplies not only by seed but also from broken rhizomes. In India it is dried and used as fodder. In Egypt it is made use of when fodder is scarce, and in lower Venetia wheat stubble among which it is found is utilised for fattening, and searched ont by farm stock. Imported by chance into the United States, where it is called " Johnson Grass " this plant has become a real weed in the southern states, but, as it has been observed to provide good fodder and, thanks to its rhizomes, to resist the severest droughts and most rigorous winters, it has been grown for some years in the semi-arid zone of the Union, from Oregon to the Gulf of Mexico, as a summer fodder plant. Mr. SCUDDER has got from it, without irrigation, in Oregon, 25 quintals of hay per hectare. With the help of irrigation, in regions where the rainfall amounts to 400 mm. per annum, up to 80 quintals of hay have been obtained per hectare from it. In the United States, Johnson grass has also been found useful as a wind break to shelter the most

delicate of the shrub crops. At the beet cultivation experiment station of Rovigo, M. Munerati planted hedges of the grass round plots of selected beet in order to prevent cross-pollination among them.

This sorghum has been imported by chance also into Australia, where it as thriven to such an extent, as to be one of the utilisable wild fodder plants.

With a view to trying the use of this plant also in Italy, where it is a wild native, the author grew experimental crops of it near Rome. As the seeds are of low germinating capacity, although maintaining their vitality for several years, he multiplied the crop from pieces of rhizomes, 5 to 10 cm. long, planted on the March 20, 1918, at a depth of 5 cm. and 5 cm. apart, in lines spaced at 30 cm., and in a mellow but very poor soil hoed on the surface and not manured. No subsequent cultivation was given. The year was a very dry one. At the flowering period in September, 7330 kg. of grass (65 % water) was harvested, which gave 2950 kg. of hay (15 % water) having the following composition : Leaves, 32 % ; stalks, 58 % ; panicles, 10 % ; and with the following chemical composition : Water 15, % ; raw protein, 6,58 % ; oils and fats (raw), 1,25 % ; non-nitrogenous extract, 27.24 % ; cellulose, 44.80 % ; ash, 5.13 %.

Similar trials made in 1919 gave like results,

Conclusions. — Cannarecchia, although it should be kept down in many cases, because it spreads everywhere, is utilisable for several agricultural and industrial purposes. Easily grown on poor soils, even barren and dry ones, it is very resistant to drought. As it continues growing during the dry season, in the most arid places it is capable of providing, at the time of the greatest scarcity of green fodder, about 75 quintals of grass per hectare or 27 quintals of hay not much inferior in quality to that of fodder sorghum. The rhizomes are still more useful than the hay ; under cultivation, a yield of 200 quintals has been obtained per hectare. They contain as much as 27 % starch and 13 % sugar (mostly saccharose), but on the other hand they contain little fibre, and hence make good feed.

From the rhizome, besides 25 % starch (air dried) there can be got 25 % sugar syrup (50 % water) which may be used either as human food or as a source of 7 % by volume of ethyl alcohol (95 %). If the rhizome is used only for making alcohol, 18 to 21 % by volume of 95 % alcohol is obtained from it.

In every way Johnson grass deserves to be included among the useful plants, especially in regions where there is a long period of drought in summer.

FIBRE CROPS

203 – **The Cultivation of Fibre Plants in Indo-China : *Agave Cantala*** (1). — I. Chevalier, Aug., in *Bulletin Agricole de l'Institut Scientifique de Saïgon*, Year I, No. 9, pp. 266-270. Saïgon, Sept., 1919. — II. Vernet, G., *Ibid.*, pp. 270-276.

The provisioning of Europe in fibre other than cotton and wool (i. e. hemp, flax, jute, henequen (2), sisal) is becoming more and more difficult.

(1) The authors designate under this name the species called *Agave Cantula* Roxb. in the *Index Kewensis*. (*Ed.*)

(2) Agave fibre, under the names of "Henequen", "Chanvre de Sisal", "Sisal hemp", "Ixtle,,, and "Tampico", has made Yucatan, formerly disowned and considered useless for agri-

Some countries, like Russia, which supplied large quantities of flax, are no longer exporters. The unsettled state of Mexico during the last few years has reduced the production of henequen, and the agave plantations of German East Africa which yielded in 1912-13 about 20 000 francs, worth of fibre, seem to be non-existent since they were abandoned during the war.

The time is therefore favourable for starting certain textile fibre crops in the French colonies.

From time immemorial in Indo-China, the Annamese have grown jute and ramie ; also the mountain population of Tonkin and North Annam grow some hemp, but the yield of fibre has always been very small.

Since 1878, attempts at the cultivation of ramie, crotalaria and *Aeschynomene cannabina* have been made under the direction of the botanist PIERRE near Saïgon. Later on, the trials were continued at Tonkin. They were concerned chiefly with jute, the textile banana tree or "abaca" agave, *Hibiscus*, and the crotalaria. At the time of the Colonial Agriculture Congress in 1918, M. HAUTEFEUILLE made public the results he had obtained (1), but they were not very conclusive.

In 1918-19, the experiments were renewed at various places in Indo-China, with the following plants : 1) flax, at Tonkin ; 2) hemp, at Laos : 3) jute, at Tonkin and in Cochin China; 4) agaves, in South Annam. The two notes summarised give the first results of the studies undertaken on the last of the above four crops, the agaves, especially *Agave Cantula* Roxb (2).

In the south of Annam, between the sea and the southern spurs of the Annam Cordilleras, there is a belt of 2000 to 3000 square kilometres lying in the provinces of Phanrang and Phanthiet, in which the desert characteristic is excessively remarkable.

This belt is very easy of access, being traversed along its whole extent by the Saigon-Nhatrang railway and including the port of Bangoï. The country is sandy, dry and arid, and certainly in Indo-China there is no district more suitable for the cultivation of the agave.

The *Agave Cantala* (the " Maguey " of the Philippines), doubtless of Mexican origin, has for long been considered to be the *Agave americana*, but latterly several American botanists have shown it to differ from the latter in some important respects. The name applied to it today was

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culture, a prosperous country (L. HAUTEFEUILLE, *L'Agave textile au Tonkin*, Congrès d'Agriculture coloniale, Série Hanoï, No. 3, Hanoï-Haïphong, 1918) (*Ed.*)

(1) See *R.* Dec. 1918, Nos. 1387 and 1358. (*Ed.*)

(2) M. L. HAUTEFEUILLE, in his paper entitled *L'Agave textile au Tonkin*, indicates the following two varieties of *Agave Cantala* : — 1) *A. Cantala*, commonly miscalled *vivipara.* ; 2) *A. Cantala variegata*, very ornamental and remarkable for the white striping on every leaf. According to this author the following are the species and varieties eperimented with at Tonkin : —(1) *A. rigida sisalana* ; 2) *A. rigida elongata* ; 3) *A. Cantala* ; 4) *A. Cantala variegata* ; 5) Agave not strictly determined, a false sisal called *lurida* in some cases and *decipiens* in most ; 6) *A. americana* : 7) *Fourcroya* (= *Furcraea*) *gigantea* ; 8) *Zapupe*, sent by the Colonial Gardens of Nogent-sur-Marne on account of remarkable qualities not yet defined. (*Ed.*)

created by the English botanist ROXBURGH for the form of it which is naturalised in British India and commonly grown, according to STEWART, in the Punjab to make hedges.

The *Agave Cantala*, although certainly of American origin, has not yet been observed in its native land, and it is known to this day only on the coasts of tropical Asia, in the Malay archipelago and in the Philippines, where it was introduced by the Spaniards at an early period. According to E. D. MERRILL, it is an ornamental plant extensively cultivated in several provinces of the Philippines for its fibre. HAUTEFEUILLE states this species also, and not the true sisal (*A. rigida* Mil.), in grown in Java for the production of sisal fibre fou export (about 4000 tons per annum).

E. D. MERRILL says that *Agave Cantula* Roxb. is synonymous with *Furcraea cantula* Haworth = *Agave Rumphii* Hassk. This would be also the *Agave americana* of RUMPHIUS (not of LINNAEUS), wrongly identified by LINNAEUS with his *Agave vivipara*. The latter species in any case remains a mystery, and it may be that this is the plant in question.

In short this species was brought from America by the Spaniards long ago, is known only in Indo-Malaya, where it is cultivated and naturalised. It is also found in abundance all along the coast of South Annam, and is sometimes planted on graves and around pagodas in the rest of Indo-China. Its introduction seems to date very far back, although LOUREIRO did not mention it in 1790 in his Flora.

In the arid belt referred to, *A. Cantula* is already very widespread. It multiplies by suckers, bulbils and seed. On dunes it appears to be a good fixing agent for sand; from this year onwards the Annam Forest Department, under the direction of M. H GUIBIER is taking up the breeding of it It is a plant which will serve for industrial uses, and the investigations carried out by M. VERNET will soon provide reliable information as to its value and the yields to be expected when it is methodically cultivated.

II. — Being struck by the growth of sisal in the region of Tourcham, in the province of Phanrang, M. CHEVALIER, Director of the Scientific Institute, requested the author to look into the question, to determine the fibre content of the leaves of these Amaryllidaceale and to investigate the possible prospects of their cultivation as textile plants.

BOTANICAL ORIGIN. — The agave is known in Cochin China and Annam by the names " Thom-tào " or " Gai-tào ", which mean Chinese Pineapple or Chinese Ramie.

This is not an indigenous species and, in spite of its name, this plant is not a native of China, but, according to the results of M. CHEVALIER, it is the *A. Cantula* Roxb. which, like all the agaves, is a native of America.

HABITAT. — A very superficial review of the matter might give rise to the belief that the agave in the Tourcham district grows naturally in the bush, without any attention whatever, and that its cultivation, on this account, may be limited to the establishment of a plantation, which need only be left to itself for a certain length of time before the owner, returning a few years later, can profit by it. Such a procedure would be a grave

mistake, and one which has in fact already given some planters a set-back which should not be repeated.

On closer examination it is found that the agave is planted by the natives in lines, on the borders of the fields as live hedges. Sometimes these hedges, when left without attention, are gradually invaded by wild shrubs ; the brushwood then slowly takes the place of the agave plants, and the whole often has the appearance of wild-growing vegetation.

Moreover, although the agave is not an exacting plant, it would be a mistake to think it acquires the luxuriant growth found in the provinces of Phanrang and Nhatrang entirely by coming up at random in the sand. In practice, as these plants form living fences round the fields, the operations of cultivation, ploughing and harrowing are the means of benefiting the plants round the border. In addition, all the plant waste that is dragged to the outside by the harrows is thrown beside the fence, where it rots and so little by little forms a top soil which is not without effect on the growth of the plants whose roots it covers. In the districts of Ninh-chu and Nhatrang, where agaves are planted along the roads, they receive the sweepings and various kinds of animal refuse. Though this plant is not exacting, since it will grow and even spread in extremely poor ground, it is nevertheless very responsive to any help in fertilising material and to all cultural operations.

The author gives two analyses of soil samples taken from the roots of the best-developed agaves in the Tourcham and Ninh-chu districts. The results of these analyses show that the soil is very sandy, containing a little lime and organic matter of which a certain proportion has already become humus. Its content of nitrogen and fertilising mineral matter is very low, but still appreciable.

Further, analyses of agave leaves show a plant whose vegetative parts above ground contain only from 15.6 to 17.8 % dry matter and 84.4 to 81.2 % water. The leaves are very poor in nitrogen, containing only 1.19 % in the dry matter.

An investigation of the mineral contents of the dry matter gave the results shown below :—

Silica	0.280 %
Phosphoric acid	0.303
Potash	1.120
Lime	3.710
Magnesia	1.320
Peroxide of iron and aluminia	0.320
Soda, carbonic acid and undetermined substances	3.087
Total ash	**10.140** %

One of the mineral elements to which attention should be drawn is the lime, which enters into the constitution even of the agave textile fibres. The mean weight of the leaves growing under good conditions being about 1 kg., it is sufficient to multiply the preceding figures by 10 in order to find out what a leaf will remove from the soil.

As each plant of *A. Cantala* has 80 to 90 leaves, it is evident that a regular plantation, in which shoots are entangled among the original plants, eventually takes up a fairly large quantity of fertilising material which will be regularly removed from the soil by continuous cropping.

The growth of agaves, with small plants from the suckers gradually increasing in number, suggests the establishment of a regular plantation, in rows 4 to 5 metres apart, with intervals of 1 metre between the plants in the rows. The intervening spaces could thus be easily cultivated and manured, and might even serve to grow improving catch crops, such as groundnuts, beans and various legumes, of which the leaves would be regularly left on the soil ; likewise small carts could pass up and down the rows when harvesting the leaves.

Growth. — Studies on the growth of agave have shown that under good growing conditions these textile plants in Indo-China can be turned to use after 3 years at most, counting from the time they are planted ont.

Fibre content of the leaves. — De-fibring was done by hand. A first operation, hammering the leaves with a wooden mallet, gave, after drying, 2.86 to 4.75 % of fibre. Complete cleaning by hand, fibre by fibre, made a difference in weight of 30.9 %.

The yield of the leaves in fibre dried in the air and perfectly cleaned by hand varied from 1.9 to 3.8 % with a mean of 2.5 %.

Agave fibre. — The bundles of fibre are thicker at the base of the leaves than at the point, and are not round but more or less flattened. Microscopic examination shows that they are made up of a large number of elementary spindle-shaped fibres, with smooth walls, united to each other, 2 to 2.5 mm. in length, of irregular polygonal section, of 0.03 to 0.06 mm. in outside diameter and 0.02 to 0.03 mm. in inside diameter. Hence the resistance or breaking strain of such bundles varies according to the part tested. By ordinary mechanical means it will never be possible to extract the fibre in all its length. i. e., totally ; in fact, it breaks near the end. According to extraction processes and apparatus used, the yields of textile fibre are suscep tible of fairly wide variations.

Conclusions. — The results obtained are encouraging for the future, and if agave fibre is not of very great intrinsic value, the quantity that can be obtained on moderately fertile land will make up for this inferiority.

It has not yet been determined how much can be produced in leaves annually from a hectare regularly planted and well maintained. Trials are to be carried out at the experiment station of Giarai (1) and others on much poorer soils at Bangoi and Dongmé, so that the question may be expected to be resolved soon.

204 – **Broom (*Spartium junceum*) and its Uses in Calabria, Italy.** — Casella, L.A., in *L'Italia agricola*, Year LVI, pp. 374-380, 1 fig. Piacenza, Dec. 15, 1919.

The broom plant is of great service in fixing land, as well as enriching it in nitrogen, being a leguminous plant. It provides sheep and goats with a pasture not to be despised, and as these animals are especially fond

(1) On the subject of the agricultural station at Giarai, see *R*, Oct. 1918, No. 1068. (*Ed.*)

of the young shoots, in order that they may not damage too much and even destroy broom lands, they should be put to graze there only after the shoots have hardened a little, in autumn and winter.

In domestic economy, broom is put to various uses small faggots are made to light fires, large sweeping-brooms, temporary roofs for huts, bands for plants fixed to props, bushes for silk worms, etc. In Calabria, when silk-worm eggs were produced, the branches, bound together in the form of small screens, served here and there for the female moths to lay their eggs on, a purpose to which they were extremely well adapted, because later on the eggs could be detached very easily, after immersion for some time in water where they were let float on the surfacce, passing them between the thumb and first finger ; by this means the eggs were at the same time washed and cleaned of unfertile specimens which float.

Broom is of limited heating capacity but gives a long live flame, which makes it useful for lighting fires or renewing them, and is of good service where flames are wanted to lap the heated surface all over, as in ovens.

For firewood, broom is cut every 3 years, towards the end of autumn, and grazing is prohibited for a year after cutting. It is a good honey-producing plant, and its seeds could be fed to poultry and pigeons.

The part of greatest utility is the bark, from which a textile fibre can be extracted. The latter is prepared, spun and woven, as a home industry in many parts of Calabria, especially the province of Cosenza. Broom-fibre fabrics are made also in some parts of Basilicata, in Tuscany (where they are called "panni ginestrini"), in the south of France and in Spain. These goods are noted for their extreme lightness ; from 11 kg. of flax as much as 60 metres of cloth may be obtained, while from only 7 kg. of broom fibre it is possible to make the same length.

These fibres are used also to make ropes and paper, which are likewise distinguished for their great lightness.

The broom-cloth industry ("panni ginestrini") includes the following operations : cutting of the branches ; boiling of same ; maceration of the boiled branches ; stripping off the bark ; beating ; swingling ; carding ; spinning of the fibre ; weaving bleaching ; of the cloth.

The branches are cut during July and August, only those of 2 years' growth being taken. They are boiled in open boilers for 4 to 8 hours, the bundles being turned over in the boiler at least once, and the operation is finished when the green colour disappears from the branches. This is a delicate process, because, if insufficiently boiled, the bark does not come off well and the fibre is not white, and if boiled too much the fibre loses in tenacity. Maceration is done in running water and lasts from 3 to 8 days. The bark is stripped by hand. Beating is done with a wooden club on a fairly even-surfaced stone, near the same stream where the maceration was done ; the operation is divided into two stages, with a rinsing in between, and requires rapid working and good weather because in the same day the fibre after being twice beaten and rinsed, must be exposed to the sun to be half dried, otherwise it darkens and loses in value. At this stage of preparation the fibre can be used for rope making. A further stage of preparation consists

in swingling, which separates the longest and finest fibres from the shorter and coarser, that is, the fibre ("manna") from the tow ("stoppa"). Both of these can be spun and woven, the former giving moderately fine cloth, and the latter coarse stuff (for bags, wrappings, etc.). Ordinary machine carding separates the fibre into high grade fibre ("cuor della manna") and tow ("stoppa") ; the former, when spun finely, can give very fine cloth of great beauty. Spinning and weaving are done by hand, with the old-fashioned household spindle. The cloth is bleached on the grass, being wetted and dried alternately.

Broom cloth is remarkable for its durable qualities ; it is said to last for centuries.

Several times attempts have been made to transform the Calabrian home cloth industry into a big mechanical one, but without success. More serious attempts were made during the war. In the Rogliano country (province of Cosenza) a workshop was set up for the mechanical working-up of the broom, but it cannot be said that the scheme has passed the experimental stage. It appears that machine-extracted fibre loses greatly in length and strength, so much so that it is utilisable only as raw material for paper making.

PLANTS YIELDING OILS, DYES, TANNINS, ETC.

205 – **Linseed: the Influence of Geographic Origin and Variety on the Composition of the Oil ; Investigations in the United States.** — RABACK, F., in *U. S. Department of Agriculture Bulletin No.* 655. 16 pp. Washington, april 20, 1918.

For 2 consecutive years 4 varieties of selected flax — C. I. (Cereal Investigations) No. 3, Damont (North Dakota 1215) — C. I. No. 2, Primost (Minnesota No. 25) — C. I. No. 13 (North Dakota Resistant No. 114) — C. I. No. 19 (Russian) — were grown in districts of Montana, North Dakota, Wyoming, South Dakota and Oregon differing greatly in climatic and soil conditions. Oil was extracted from the seeds thus grown and a determination made of the colour, specific gravity, refraction, acidity, saponification and iodine indices, and drying properties.

To determine the yield of oil of the seed, extracting was done with ether, and to obtain samples for finding the physical and chemical constants cold pressure was used.

The following conclusions, shown in a series of tables, were reached from the results of the analyses :

Varieties of linseed which have different agronomic properties show also different physical and chemical properties in their oils. These properties keep up in a very marked manner from one year to another. The yield of oil changes both with variety and with locality. The specific gravity, refraction index and colour cannot be so easily correlated with the variety and locality. A direct relationship appears to exist between the drying properties of the soils on one hand and the specific gravity, acid index, iodine index and colour on the other hand. Oils having at the same time a strong acidity and high specific gravity, and also a relatively high iodine index, dry more rapidly, forming a solid film. Oils of lighter colour invariably dry more rapidly.

206 - **The Effects of Irrigation on Olive Production, in Tunisia.** — MARÈS, R., in *Revue de Viticulture*, Year XXIV, Vol. LI, No. 1315, pp. 168-171. Paris, Sept. 11, 1919.

Few crops in North Africa cost more for irrigation water than tree crops. No other crops give more constant and lucrative yields, for little capital outlay, in the countries round the Mediterranean basin with a climate too dry and too irregular to allow of cereal growing. Moreover, in those parts where the existing population has acquired a certain density in consequence of peaceful times or prolonged security first fruit trees were planted and then it was endeavoured to increase their yield by bringing under control springs, rivers, and subsoil and rain water.

Algerian vine growers have given a striking example in not hesitating to bore as deep as 40 metres in search of water to irrigate their vineyards.

Under these conditions the water costs about 0.10 fr. per cubic metre, a price which is equivalent to a sum of 3000 fr. a year for 1 litre of water per second continually. Almost equally costly plant is set up to water citrus plantations where the rainfall is deficient.

In the Sahara, however, where dates are grown, water reaches a value unheard of in all other places. It has been calculated that in the Biskra oasis a litre per second comes to cost the user a net sum which may amount to 10 000 francs. This is far beyond the value of the irrigation water used for fodder plant or cereal production in temperate countries, where 50 francs appears to be the maximum rate.

The olive, which is usually regarded as a tree of arid land, gives the water used for it a very high value, and being the fruit tree par excellence of Tunisia, the country of place, sobrety and thrift, it is there more frequently irrigated than is generally believed.

In Tunisia, the advantages of olive irrigation by flood water have been more appeciated than anywhere else, although it has been carried out with very precarious supplies of water.

Near the desert limit, north of Gabes, some olive groves have been laid out so that they are flooded every time there is flood water, and their yields testify to the benefit of these irregular floodings in this arid district.

In the Tunisian Sahel, all running water is diverted with great care into the olive plantations. The hill tops are provided with rain-water tanks and the water is distributed to the groves spread over small areas on the hillsides and in the valleys.

In the north of the Regency, the fine, olive trees of Nebur, Kef and Tebursuk show the benefits of irrigation by their high and regular yields.

In an experiment made at Grombalia (by M. E. DUMONT), according to whether the olives were watered or not, the yield per tree varied from 180 litres of olives weighing 125 kg., capable of giving 19 kg. of oil (worth 38 francs, at 2 fr. per litre), to 20 litres weighing 15 kg. and equivalent to 2.5 kg. of oil (worth 5 francs).

Another example of the effects of irrigation on olives is furnished by the school farm of the Israelite Alliance of Djedeida.

This farm owns 7300 young olive trees, of which 2000 began to be watered in 1900-1901, while the other 5300 were not watered. The following

table gives a summary of the results obtained in this olive plantation b irrigation :—

Years	Yield from	
	2000 trees watered	3500 trees not watered
1900–1901	45 000 kg.	45 000 kg.
1901–1902	23 000 »	26 000 »
1902–1903	10 000 »	2 000 »
Totals . . .	**78 000** kg.	**73 000** kg.

Hence the watered trees gave an average annual yield of 13 kg. pe tree, whereas those not watered did not yield over 4.6 kg.

In view of the high prices prevailing for olive oil, the few example cited above show that watering the olive trees should never be neglecte at flowering time and in autumn wherever it is economically possibl

RUBBER, GUM AND RESIN PLANTS

207 – **Gum Tragancath in Mesopotamia.** — *The Board of Trade Journal*, Vol. CIII, No. 119 pp. 623-624. London, 1919.

The most valuable gums of Mesopotamia are the gum tragacanth which are produced by tapping small shrubs. These shrubs appear to gro all over the mountains of Southern Persia, and from there through the en tire mountainous region which runs North-West along the frontiers of M sopotamia, comprising auch areas as Northern Arabistan, Luristan, Pus i-Kut Country, and Kirdistan. The most important collecting centr for Baghdad is Suleimanaya, the capital of the Suleimanaya district Kurdistan, situated about 180 miles to North-East of Baghdad. In th area there is a regular trade in this gum for the Baghdad market.

The method of tapping the bushes is as follows :— The Kurds firs burn all the leaves off the bushes, then expose the roots, cut incisions i the roots, and leave them for a week or so ; they then return and collect th gum which exudes from the roots. The first tapping produces white gu of the best quality, second and subsequent tappings, gums of yellow c lours and inferior quality. Excessive tappings weaken and may kill th bushes if done to excess.

The Kurds bring the gum to Suleimanaya, where it is bought by loc merchants, who export it to Baghdad on pack transport in caravans, an sell to Baghdad merchants. These merchants export to England and othe foreign countries. The local Customs authorities levy a 12 ½ per cen tax on the market value in Suleimanaya.

The northern mountainous Kurdish country in the Musul Vilayet a mass of mountains and valleys. The mountains are covered with scru evergreen oak forest, and the higher hills and plateaux are full of thes gum bushes (called, " guweyni " or " guni " in Kurdish). In spite of th prevalence of these bushes, no organised trade appears to exist, althoug Persian merchants are said to have come down off and on in the past t

exploit these gums. The distance from Mosul town to this gum-bearing country is from 50 to 100 miles. All transport at present is on pack animals, but three unmetalled roads up to the hill country have been constructed. The country is at present wild and unsettled, but with the introduction of law and order, the opening up of the country by means of roads and the construction of a railway to Mosul, the exploitation of gums in this country should be possible in the near future. The export from Bagdad in 1887 was 641 250 kg. (= 130 tons), and in 1890 it had decreased to 39 tons.

A second kind of gum is produced from a large tree, which grows throughout the part of Kurdistan. The tree is known as " Buttom " by the Arabs and " Gkraswan " by the Kurds. It grows to a great size, 50 feet high and up to 8 feet in girth. It is found scattered throughout the valleys only, especially near the villages in the forests. The tree produces edible fruits (sold for food and for extraction of oil in Mosul, Baghdad, and all other local markets of any size in Northern Mesopotamia), and also a gum, called " elk " in Arabic. The method of tapping this elk gum is by making long incisions in the trunks of the trees, and placing some receptable underneath to catch the exuding gum.

A regular trade in this gum exists in the Suleimanaya district of Kurdistan, but there is no trade whatever in that part of Kurdistan which falls in the Mosul Vilayet, although " Button " trees abound in the valleys of that country. The bu'k of " e'k " gum is exported direct from the Suleimanaya district by caravan to Aleppo, where it is used for sizing cloth. Some portion comes to Baghdad. There is no foreign export of this gum from Baghdad ; it is all used up locally for sizing cloth, local medicines, as a local chewing gum, and in the manufacture of arrack liquor from dates. There is no doubt that very large amounts of this gum could be collected from the areas mentioned, under conditions similar to those already described for the gum tragacanth.

208 – **Sugar-beet Growing Experiments in Oran (Algeria).** — VERMEIL, P. (Director of the General Agricultural Department at Oran), in *Revue de l'Afrique du Nord*, Year XVII, No. 18, pp. 304-310. Algiers, Nov. 28, 1919. SUGAR CROP

As the sugar question is of such pressing importance at the present time, it is good that Algeria should set to and produce sugar for her own consumption, seeing the warm climate is so favourable to beet growing.

Oran consumes 12 000 to 13 000 quintals of sugar per month. It is doubtful whether it can produce so much, but it can produce a good part of this quantity. The climate would certainly allow, by intelligent and judicious cultivation, of eventually having richer beets, with a greater weight of roots per hectare and consequently a higher yield of sugar from an equal area than in France.

The economic side of the sugar industry in Algeria has not yet been definitely settled. The author studies the sugar question only from the technical point of view.

The area devoted to beet growing will always be limited in Oran owing to the lack of water. The best-situated districts will be those in which there

are barrages, rivers with water in summer; such are the Felat, Sig, Perregaux, Relizane districts, then Bel-Abbes, Ain-Temouchent, where the soils are rich and cool in summer, and perhaps also Saïda which will supply sugar in the south.

The indispensable condition for enabling a sugar factory to be set up is to be able to dispose of 1200 to 1500 hectares of land, within a radius of 5 to 6 kilometres at most, adapted to beet growing (in practice, a factory ought to work at least 120 000 quintals of beet during the season; if the yield is 300 quintals per hectare on the average, 400 hectares will be required per annum, or 1200 to 1500 hectares of land suitable for this crop, when it comes into the rotation).

The quality of the soil and water plays an important part, as the richer the juice is in salts the lower is the yield of sugar. In this respect the Tell district in Oran is badly situated, the irrigation water and much of the cropped land being rich in chlorides and in carbonate of lime. Mascara, Saïda and Fiaret offer much purer springs and soils in this respect.

The author gives an account of the experiments he has carried out on beet growing. Six varieties from the firm of VILMORIN were tried (4 sugar and 2 half-sugar), sowing being done in spring, as the seed arrived too late for autumn sowing, at the following places:— experimental plots at Oran, on the Habra estate, at Trois-Marabouts, on M. NORREN'S property, and at Temouchent.

Table I sums up the results obtained.

TABLE I. — *Results of beet-growing experiments in Oran.*

Varieties	Weight of roots per hectare in kg.	Sugar content %				Yield of sugar per hectare in kg.				Observations
		Habra estates		Oran	Témouchent	Habra estate		Oran	Témouchent	
		Unirrigated	Irrigated	Irrigated	Irrigated	Unirrigated	Irrigate	Irrigated	Irrigated	
1) Improved white sugar beet, Vilmorin *A* . . .	38 540	14.00	9.60	11.80	12.40	5 400	3 700	4 550	4 800	For want of more exact data, the weight of roots per hectare was taken to be the same as at the experimental plots at Oran.
2) Improved white sugar beet, Vilmorin *B* . . .	50 130	13.90	12.00	10.00	13.00	6 970	6 015	5 013	6 520	
3) White sugar beet Française riche	46 340	13.20	8.00	10.00	13.60	6 120	3 710	4 634	6 305	
4) Improved white sugar beet, Klein Wanzleben	40 500	14.80	10.80	8.40	12.00	6 000	4 375	3 405	4 860	
5) Distillery beet, green neck	55 120	10.00	7.90	8.00	7.20	5 512	4 355	4 410	3 880	
6) Pink distillery beet, green neck	50 200	12.00	8.00	3.20	2.60	6 025	4 016	1 606	1 305	

The maximum richness in sugar was got on the Habra estates with unirrigated beet of the variety Klein Wanzleben. The least rich beet was the irrigated crop on the same estates, with the white variety Française Riche.

The highest yield of sugar per hectare was given by the improved white sugar beet Vilmorin B on the Habra estates (6 970 kg.) ; the lowest by Klein Wanzleben, at the experimental plots at Oran (3 405 kg.)

The sugar content is about the same as in France, where it varies between 12 and 14 per cent. On the other hand, in France the yield of sugar per hectare scarcely exceeds 3500 to 4000 kg. because the yield of roots is lower than that obtained in Oran.

The experiments seem to indicate that large roots are not much richer in sugar than small ones ; some are of exactly the same composition. Beets pulled on July 20 are appeciably richer than those pulled on June 20. The roots could be kept without inconvenience in the ground up to the middle of August or even till the end of September in the cool soil of Temouchent. By this means the rainy season could be awaited before starting the factories, which would then have pure water for the diffusion process. Besides the roots are difficult to pull before the rains, on hard strong soils, and many of them are broken.

Cultivation trials made on the estate of M. PANSARD at Montgolfier with 4 varieties sown in spring and pulled at the end of October, gave the results shown in Table II, which confirm the author's conclusion regarding late pulling.

TABLE II. — *Results of experiments at Montgolfier on M.* PANSARD'S *estate.*

Names of the varieties from M. PANSARD'S estate	Weight of roots per hectare	Sugar content	Yield of sugar per hectare
1) White, sugar, Vilmorin *A*	40 125 kg.	14.2 %	5 697 kg.
2) White, sugar, Vilmorin *B*	33 850	12.	5 062
3) White, sugar, Française Riche Fouquier.	39 800	11.	4 378
4) White, sugar, Wanzleben	33 600	16.4	5 510

Lastly, exposure of the pulled roots to the sun quickly gives a greater concentration of sugar in the beets. Only the water in them evaporates, and the roots gradually dry After 18 to 20 days they begin to get wrinkled and have lost 35 to 40 per cent. of their weight. At this time the sugar content rapidly increases and may easily reach 18 to 20 per cent. Hence the sun might bring about a real first concentration of the juice, and the beets could be worked only when the saccharimeter indicated a minimum content of 15 to 16 % of sugar.

The Habra experiment station will continue the author's researches, with all necessary precautions and care.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

209 – **Tea Growing in the Dutch East Indies** (1). — BERNARD, C. (Director of the Tea experiment station at Buitenzorg, Java), in *Revue Générale des Sciences*, Year XX, Nos. 17-18, pp. 516-521, 3 fig. Paris, Sept. 15-30, 1919.

In statistics dealing with the growing of and world's trade in tea, in most cases considerable space is given to British India and Ceylon, China and Japan, but Java either is not mentioned or is only occasionally indicated amongst the " other producing countries ". The author finds no justification for this, considering the importance acquired by tea production and the great progress made by it, within a comparatively short space of time in the Dutch colony.

The quantities of tea exported in 1915 reached the following figures :—

British India	over	154 million kg.
Ceylon	about	97 » »
China	over	177 » »

In that year, Java produced 40 million kg. whereas in 1903, for example, her exports of tea came to only 10 million kg. (in 1910, a little over 18 million, and in 1914, about 32 million). In 1915 there were in Java nearly 30 plantations, with a total area of about 75 000 hectares.

During the last few years, as land for tea growing has become scarcer there, it has become necessary to look to other islands of the Dutch Indies, Sumatra in particular, where large stretches of land are still available. At the end of 1915 there were already over 20 plantations in Sumatra, covering some 6000 hectares.

Plantations are generally of 350 to 700 hectares in extent, and the production in most cases is from 300 to 1500 kg. per hectare. These figures, it will be seen, stand comparison with the results obtained in Ceylon and British India, where tea growing is carried out on an intensive scale, backed by powerful financial assistance (while in China and in Japan it is in the hands of the small cultivator). It should be added also that in Java the native population grows tea as well, and that the importance of the cultivation is in no wise negligible ; the tea gardens are of 1 to 10 hectares and over in extent (sometimes up to 20 hectares and over) and in 1919 covered a total area of nearly 20 000 hectares, yielding over 16 million pounds of tea, which means to the native population a gross gain of 260 000 Dutch *florins* (7 488 000 francs *at par*).

Java tea is of very good quality, as shown by the prices obtained on the London and Amsterdam markets ; in the last few years many consignments have fetched 1 shilling and above per pound at London.

The tea plant grows best in a warm moist climate. During the whole growing period, (and, consequently, producing period) it needs constant rains alternating with short dry periods. Bright mornings followed by

(1) As the Dutch East Indies belong to the Middle East, it may be useful, to complete the tea question in this vast zone, to refer the reader to what has been published on tea in Indo-China (the subject of tea in British India and Ceylon being well known) :— see *R.*, Nov., 1918, No. 1243, *R.*, April, 1919, No. 467 and *R.*, June, 1919, No. 601. (*Ed.*)

wet afternoons constitute very favourable conditions for the tea plant. This means that districts suited for tea growing are on the whole fairly limited ; in Java these conditions appear best for the crop in the western part of the island, but it has been possible, often with some success, to establish tea plantations also on the mountain slopes of the centre and east.

The tea plant is not very exacting with regard to soil ; recent volcanic soils, however, rich in humus and containing a sufficient proportion of sand and clay appear to suit it best.

As to altitude, it has long been admitted that between 600 and 1000 metres is best for tea planting, but plantations established in the last decades up to 1800 metres and above have given excellent results, both as regards the quantity and quality of the product.

At present only good types of Assam tea are planted. The old China tea gardens have been mostly cleared out and replanted with broad-leaf types. The vigour of the plants, and the size and colour of the leaves differ according to the variety adopted. Seed gardens are being more and more established in Java where the plants have undergone strict selection and produce descendants of a pure type possessing the properties required for a given plantation, but the production of the existing seed gardens in Java is not sufficient to meet the ever-growing demand for the crop, and large quantities of seed have to be imported every year from British India.

The seeds are generally sown in nurseries and put in about 15 cm. apart at a depth of 2-3 cm. In some districts, if climatic conditions are suitable, the seed may be sown directly in the cleared gardens. In places where prolonged periods of drought are to be feared, the nurseries are covered over with temporary shades to protect the young plants against the heat of the sun.

When the seedlings in the nurseries are of one or two year's growth, they are transplanted to the gardens, which have been previously cleared out (trees removed and soil cleaned of weeds and ploughed). The lines have been determined in advance, following the level on the slopes and leaving a space of about 120 cm. between them, and it is along these horizontal lines that the young plants are put at distances of 90 cm.

Cultivating and weeding must be regularly done ; a system of terraces, drains, and ditches to hold the water and so prevent erosion is established ; the manures considered necessary are applied ; and leguminous crops are planted for green manure. In short, all the necessary steps are taken for the judicious working of an intensive cropping system.

Tea plants in Java are attacked by certain enemies and diseases. The worst trouble is caused by an insect (*Helopeltis* sp.) which by piercing the young leaves totally destroys them ; plants thus affected often fall prey to numerous parasites of animal or vegetable origin ; an orange coloured mite (*Brevipalpus* sp.), though on the whole less injurious than the *Helopeltis*, nevertheless in some districts, especially on high plantations, causes fairly serious damage, of more importance than that due in British India to " red spider " (*Tetranychus* sp.), which in Java is of little account. The roots are often attacked by fungi of different species, which grow on all

kinds of decomposing vegetable refuse and pass from there to the tea plant roots. Plants thus damaged die off and the disease spreads to neighbouring bushes. Caterpillars, plant lice and various fungi often attack the leaves of tea plants ; against these, early and energetic measures must be taken to avoid serious damage being done.

When the plants are 2 or 3 years old they are pruned for the first time, and this operation is repeated every 18-24 months according to circumstances. It is mostly owing to judicious pruning that the bushes come to have their characteristic shape :— single stem, branched more or less near the ground, with plenty of small branches which at a height of 1 or 1 ½ metres form a flat or convex surface of large diameter from which the twigs will spring which will provide the leaves to be picked.

The author then remarks on methods of picking and preparing the tea leaves ; Java tea never undergoes any process or mixing which affects its purity, and it is not scented artificially (1).

It would be impossible to establish, even roughly, any rule for the outlay necessary to establish a tea plantation in the Dutch Indies, and consequently it is very difficult to say how much capital is required to work 700-800 hectares, for example. Everything depends on local conditions, the lie of the land, the nature of the soil the vegetation covering it before clearing, facilities for communications, setting up the factory and, above all, the supply of labour. A well-situated plantation can be worked with a capital of 200 000 to 300 000 *florins* (about 46 000 to 625 000 francs *at par*), while another of the same area will hardly have enough with 600 000 *florins* (about 1 2050 520 francs *at par*).

The experiment station attached to the Department of Agriculture at Buitenzorg is studying many of the questions that arise in connection with the growing and treatment of tea. The result of these investigations is published in a series of pamphlets, *Mededeelingen van het Proefstation voor Thee* (Communications of the tea experiment station). There exists also a tea-examination bureau which examines tea samples from the commercial point of view and gives advice as to modifications which should be introduced into the treatment.

210 – **Brazilian Cocoa**, in *Bulletin commercial de la Section des Affaires économiques et commerciales du Ministère des Relations exétrieures*, No. 8, p. 17. Rio de Janeiro, Feb 1919. (Communicated by Prof. Deoclecio de Campos, Delegate for Brazil to the International Institute of Agriculture).

All species of the genus *Theobroma* are of American origin and were grown by the aborigines before the European conquest.

Chocolate is largely consumed all over the world, and chiefly in the United States. United States soldiers all carry a chocolate ration in their haversacks, and the War Trade Board recognises the importance of chocolate for the use of the army and navy.

(1) Regarding the preparation of Java tea, the observations and experiments made on this subject are described in *R.*, Oct., 1917, No. 955. (*Ed.*)

Before the war, the countries which consumed chocolate on a large scale were the United States, Germany, France, Netherlands, Switzerland and Spain. Since the beginning of the war, Germany found it impossible to import cocoa, and the other countries had to restrict their purchases on account of freightage difficulties. A reduction in consumption therefore took place, and production, which had been continually increasing so as to meet the rising demand, always constant before the war, did not go down, which naturally led to difficulties for the producers. The war being finished, the demand for chocolate should become still greater.

The production of Brazil, which is centred mostly in the States of Bahia and Para, is becoming more and more abundant and by all appearances it will be the foremost in the world in a short time.

The cocoa production for 1918 has been estimated as follows : —

Gold Coast	76 000	metric	tons
Brazil	60 000	»	»
Ecuador	32 000	»	»
St. Thomas	30 000	»	»
San Domingo	23 000	»	»
Trinidad	21 000	»	»
Venezuela	12 000	»	»
Grenada	7 000	»	»
Jamaica	3 000	»	»
Haïti	2 000	»	»
Other countries	28 000	»	»

The total production is over 300 000 metric tons.

The consumption of cocoa has not gone down in any way ; on the contrary it has been always increasing The only effect of the war has been to retard a little its upward curve.

During the years 1914 and 1915 the consumption of the principal importing countries was estimated as follows:—

Countries	1914	1915
	metric tons	metric tons
United States	74 379	84 181
Great Britain	29 038	47 267
Germany	49 707	43 600
Netherlands	32 095	40 955
France	28 140	31 000
Switzerland	10 078	11 311
Spain	6 912	6 512
Austria-Hungary	7 647	5 650
Italy	2 275	4 093
Belgium	6 164	3 800
Other countries	16 463	15 931
Totals	**262 900**	**294 300**

Method of Exporting. — The cacao is exported in bags, the weight of which varies according to the producing country. In Ecuador the bags are of 80 kg.; in Trinidad and Grenada they vary from 80 to 100 kg. and in Venezuela from 50 to 60 kg. Brazil employs a uniform weight of 60 kg., and also the Gold Coast and St. Thomas.

Export from Brasil. — Brazil exported only 20 000 tons of cacao in 1902 but in 1917 the quantity exported came to 55 622 tons, having a value of 48 084 000 *paper milreis* (1) or £2 536 000. The exports of cacao in 1917, by ports of origin, were as follows:

Ports of origin	Kg.	Value in *paper milreis*
Manáos	242 739	181 126
Itacoatiara	221 862	182 435
Belém do Pará	4 255 667	3 811 681
Maranhão	5 210	4 343
Fortaleza	1 771	2 150
Pernambuco	2 288	1 657
Bahia	44 527 063	37 495 015
Victoria	6 600	6 760
Rio de Janeiro	6 202 918	6 253 207
Santos	146 320	146 000

According to counries of destination, the same exports are distributed thus:

Countries of destination	Kg.	Value in *paper milreis*
Argentina	1 110 110	935 609
China	148	144
Denmark	468 000	450 420
United States	37 930 299	32 652 278
France	11 856 822	10 310 228
Great-Britain	274 172	249 125
Netherlands	1 219 000	1 004 129
Spain	274 172	249 125
Italy	265 200	243 030
Japan	1 800	1 746
Norway	482·250	420 091
Portugal	52 371	49 091
Sweden	344 000	293 820
Uruguay	216 000	185 286

(1) 1 *paper milreis* = 1.s 4*d.* *at par.* (*Ed.*)

211 – **Cultivation of Medicinal and Aromatic Plants in the Royal Botanic Gardens, Naples, Italy.** — *Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year II, No. 11, pp. 164-170. Milan, Nov., 1919.

During the war, the Royal Botanic Gardens at Naples grew many medicinal and aromatic plants, which were studied from the chemical point of view at the Institute of Pharmaceutical Chemistry at the University, and from the physiological standpoint at the Medical and Pharmaceutical Experimental Institute.

The plants experimented with were : castor oil ; digitalis ; belladonna henbane ; stramonium ; mallow : pyrethrum ; balm angelica ; fennel ; *Iris pallida* ; wormwood ; caraway ; patience ; thyme ; camphor tree ; golden seal ; *Rhamnus Purshiana* (cascara sagrada) ; *Convolvolus* sp. ; etc.

A larger area was devoted to castor plants in order to study what would be the best varieties most resistant to drought. By selection fifty varieties were obtained, with a good yield and oil content (from 47 to 58 % in 40 varieties), among which the best are : — *Ricinus sanguineus* in selected forms ; Scafati castor ; some varieties of *R. zanzibariensis* and of *R. Gibsoni* The varieties of the country, namely those cultivated for long in the districts of Verona and Nocera, give an oil yield much higher than that of the Hindoo varieties which before the war provided the greater part of the seed crushed in Italy.

It was found that farmyard manure is a very effective manure to use. Phosphatic fertilisers alone, or better still, along with nitrogenous manures, are good for seed production. Excellent results were got by using silk-worm refuse, alone or mixed with sulphate of ammonia or nitrate of soda. Good results were obtained also with cyanamide.

The light soils of Campania can carry 8 000 castor plants, and give a yield of 16 to 22 quintals of seed, per hectare.

Experimental crops of *Digitalis purpurea* were made on a large scale. Biological estimation of the active principles extracted from the leaves dried in the shade, according to the Focke method (sub-cutaneous injection of a titrated infusion of the leaves in a frog, and observation of the rhythm of the exposed heart) led to the conclusion that nitrogenous manures, as was to be expected, favoured the elaboration of glucosides in digitalis, and that the *fastuosa* and *pelorica* varieties, selected for their stronger growth of leaves, are the most active.

Belladonna (*Atropa Belladonna*) gave two crops of leaves per year, in June and in September. The possibility of using the bracts for pharmaceutical purposes is being studied.

Of henbane (*Hyoxyamus niger*) the type or variety *pallidus* was grown. It requires a fresh, well manured and irrigated soil.

The mallow (*Althaea officinalis*) did well in a rainy year. The roots can be used after 2 years' growth.

Pyrethrum showed itself resistant to drought. It comes up regularly on light volcanic soils.

The officinal balm, wormwood, aniseed, fennel, caraway, patience, valerian, thyme and stavesacre grew regularly and produced large quantities of seed.

The *Iris pallida*, the rhizomes of which were got from Tuscany, grew quite well. Two-year old plants even flowered but this plant is exacting as regards water.

Some specimens of *Rhamnus Purshiana* did well, a fact which indicates the advisability of growing the plant more widely.

On the other hand, the few rare rhizomes of golden seal which the Botanic Gardens were able to procure did not succeed.

The perfume roses (*Rosa damascena*, " Hay's hybrid " and *Rosa centifolia* did very well.

FRUIT GROWING

212 – **A Possible Method for Retarding the Flowering of Fruit Trees.** — DIÉNERT, F., in *Revue de Viticulture*, Year XXVI, Vol. LI, No. 1328, pp. 379-380. Paris, Dec. 11, 1919.

For a long time fruit growers have tried to get fruit at a time of the year different from the normal crop season. Fruit grown under glass in mid-winter fetches a very high price. By forcing crops in order to obtain these late fruits, however, a rest must be given to replace artificially the natural winter rest ; this is done by menas of anaesthetics or cold.

For certain fruits, it would be of advantage to obtain late crops ; thus, for example, cherries sell much dearer in August than in June. If these could be got in September or at the beginning of October, their sale would be still more profitable (in any case, cherry trees need only a temperature of 8°C. for flowering).

In April, 1919, the author chanced on an experiment that showed how to obtain cherries late in the year. Following on the use of chlorine, the growth of a cherry tree in the open was affected by the vapour and stopped. In September one part of the tree flowered and in October another part. The September flowers yielded fruit about the end of October.

This chance experiment shows that by the proper use of an asphyxiating gas the growth of a tree placed in the open can be arrested and fruit can be had later than the normal season. In this direction there is a field for further investigation.

213 – **Methods for Heightening the Colouring of Fruit.** — TRUELLE, A., in *La vie agricole et rurale*, Year IX, No. 35, pp. 123-125. Paris, Aug. 16, 1919.

Colour counts for a great deal in the market value of fruit, which has to satisfy the consumer not only in taste but also in appearance.

It is admitted that the red colour develops by preference in sunlight and when there are frequent alternations of warmth in the daytime and cooling off at night, as is generally the case in autumn. Morning dew also, according to BECHTLE, has a favourable effect in this respect.

On the basis of these observations, the author advises two operations : — removal of leaves and watering.

Leaves should not be removed all at once or too quickly. They must be taken off one by one and on several different occasions, not by tearing

them off, but by cutting through the middle of the stalk, so as to spare the eyes at the base. They must be removed only in the evening or in dull weather, when transpiration is greatly reduced.

With the peach, which has a very sensitive epidermis, the process must be very gradual, e. g., uncovering the fruit in three operations.

With the finest apple, in particular those of the " Api ,, variety, gardeners grow them in individual bags which they gradually tear off at ripening time. They even turn the apple on its stalk so as to expose several sides to the sun.

Leaf removal is practised also with " chasselas ,, grapes in order to get the golden colour.

Watering consists in spraying with a syringe in the September evenings, when the day has been warm, and aiming preferably at the side exposed to the sun, so as to bring about enlargement and colouring. M. Opoix, chief Gardener at the Luxembourg Gardens in Paris, advises the use of water containing a handful of salt to every 10 litres of water.

214 – **The Forests of Greece.** — Massias, J., in *Revue des Eaux et Forêts*, Vol. LVII, No. 11, pp. 237-247. Paris, 1919. FORESTRY

Extent and Distribution. — In old Greece, as it was before 1913, if all the areas legally considered as forests and superintended by the Forest Service are included, the wooded area would amount to 17-18 % of the territory, a proportion of afforestation similar to that in France. If, however, only the real forest blocks are considered as forests, it may be said there are about 800 000 hectares of forests, or a proportion of about 12 %.

As regards the new provinces, Macedonia, Epirus, Crete and islands of the Aegean Sea, it is estimated that the wooded areas represent about 14 % of the territory. Generally speaking, the forests of Macedonia and Epirus are much richer than those of old Greece. In Crete and in the Aegean Sea islands forests are not very numerous except in a few cases, as for example in the island of Thassos.

It results from the foregoing figures that for the whole of present-day Greece, including the new provinces, the wooded area amounts to about 13 % of the country. From the point of view of ownership, about 50 % of the forests belong to the State, 20 % to convents or to communes, and 30 % to private individuals.

Composition.— For the provinces of old Greece, the only parts for which at present fairly precise data are available, the proportions of the various species is something like the following : — Aleppo pine 30 % ; spruce 25 % ; oak 20 % ; larch 5 % ; beech 5 ; various : — chestnut, *Pinus pinea*, hornbeam, elm, maple, ash, lime fruit trees, etc., 10 %.

Oaks are represented by numerous species, the proportion of which is much as follows : — *Quercus conferta* 35 % ; *Q. pubescens* 35 % ; *Q. Aegilops* 10 % ; *Q. Ilex* 8 % ; *Q. sessiliflora*, *Q. pedunculata* and *Q. Cerris* 12 %.

Production. — The total annual production of the Greek forests

and the corresponding value may be estimated as follows for the period 1905-1911 : —

60 000 cub. metres of timber, worth	3 000 000	fr.
15 million *zygies* (1) of firewood, worth	15 000 000	»
16 million *okes* of charcoal, worth	2 400 000	»
10 million *okes* of resin, worth	3 000 000	»
8 500 000 *okes* of vallonia, worth	1 300 000	»
Various products (tanning and colouring matter)	300 000	»
Total	25 000 000	fr.

In addition, about 370 000 quintals of lime, valued roughly at 1 million francs are produced in the forests, and grazing for sheep and goats constitutes an indirect product which may be valued at about 7 million francs.

Hence the total yield from the forests of old Greece would represent about 33 million francs, but this is quite a theoretical estimate intended merely to show the part played by the forests in the total national wealth, since a large proportion of these products is not transformed into money.

The foregoing figures show how great a value, in the total production, the by-products have, compared with the main product, namely timber. Thus, in some privately-owned forests, the revenue brought in by the letting for grazing and the sale of resin is much higher than that from the sale of charcoal and wood. This disparity is naturally all the greater, the worse the estates are managed as regards forests. On the other hand, it may be observed how low the proportion of commercial timber is compared with firewood. This is due to various causes : primarily the composition of the woods and the low fertility of the soil, the poor management of the forests, the large number of illegal actions, and in particular the customary rights of the peasants to firewood, with the resulting abuses.

This deficient production of timber necessitates the annual importation into Greece of over 100 000 cubic metres of timber, a quantity much greater than the home production.

Regulations and Administration. — In Greece, all forests, whatever their ownership, come under the forest regulations. There is no forest code, but the laws are the result of a large number of texts, some of which are already very old. During the last few years, however, the insufficiency of these laws has been remarked and attempts have been begun to complete them. Two recent laws in particular deserve mention : one dealing with fires, the other with reforestation.

Greek forests, especially in the low-lying districts where Aleppo pine predominates, are much exposed to ravages by fires, which are sometimes intentionally lighted by shepherds. A law passed in 1914 prescribed excellent measures both for lessening the number of fires and for minimising the resulting damage. These provisions consist mainly in pro-

(1) 1 *Zygie* = 1 000 *okes* ; 1 *oke* = 2.75 lb. (*Ed.*)

hibiting the lighting of fires in any forest during summer,in creating safety fire-belts and in protecting burnt areas for 10 years.

Much will have to be done in Greece as regards the restoration and re-wooding of the mountains. On the slopes of many mountain chains there are huge stretches of formerly wooded ground which have been reduced to the condition of waste land or entirely denuded through abuses in exploitation or in grazing and through fires. The question of re-planting was the object of a special law, passed on May 3, 1918, which provides for the setting up in each commune of a Reforestation Commission including the head of the commune and 4 members: officers or private owners. These Commissions will be nominated to specify the areas where re-planting or protection is necessary. The protection of the ground may consist mostly in forbidding or regulating grazing and exploitation. The work of re-planting will be carried out either by the proprietors or by the State, after the purchase of the ground by agreement or by expropriation.

Two new laws passed by the Parliament December 26, 1918, will allow of several important improvements being realised soon.

The first of these laws regulates the method of management, as regards exploitation, of forests belonging to estates, communes, public and private establishments, as well as of those under litigation and unallotted, it revises and codifies the existing customs with regard to rights of usage; especially the gathering of firewood by the peasants, giving the local authorities the right of determining the enforcement of the provisions; and in connection with taxes, it slightly modifies some of the tariffs at present in force.

The second law establishes the basis of a new organisation of the Forest Service. In future the staff will include 20 inspectors, 120 district chiefs, 50 head foremen, 150 foremen and 850 guards. The recruiting of the lower grades of staff will continue to be done from the two guards' schools, but in order to be able to fill quickly the extremely numerous vacancies that exist at present, the law provides, as a temporary measure, for the admission to the forest service of ex-soldiers, preferably non-commissioned officers, who will be nominated under-guards and will be promoted only after being passed by one of the schools for guards. As regards agents, a measure of this nature is not practicable, and it is only in a few years that the working of the Higher Forestry School at Athens, established in 1917, will enable the present shortage of staff to be made up. Only then will the new organisation be able to be put fully to work and many of the reforms involved be able to be realised.

215 – **The Forests of Madagascar** (1). — GRANDIDIER, G. (General Secretary of the Geographical Society), in *Revue générale des Sciences*, Year XXX, No. 21, pp. 624-629. Paris, Nov. 15, 1919.

Madagascar is not much wooded : the central heights are practically devoid of trees and the southernmost part, where the climate is very dry,

(1) See *R.*, March, 1919, No. 274, p. 275, and *R.*, June, 1919, No. 742, Part XII, p. 758. (*Ed.*)

shows only a scrub with occasional trees and plants adapted to dry conditions. The only really wooded parts are: —

1) First, and mainly the eastern side, along the whole of which extends without a break, from Fort Dauphin to near Vohémar, to a width of 50-70 kilometres, the great eastern forest, composed almost entirely of evergreen trees and cut into by numerous and vast "sahavoka", bare or unwooded, immense glades covered with large herbaceous plants, bamboo, "ravinala" or travellers' trees, and small thickets.

2) Secondly, the western region, where the trees, whose leaves fall during the dry season, form more or less extensive forests, distributed here and there over the whole of this zone, and stretching parallel to the coast from Cap d'Ambre to Onilahy in wide belts which are not continuous and do not present unbroken forest as in the eastern region, but form large blocks intersected by bare spaces or, more often, by plains dotted with isolated trees or thickets.

The author describes these forests of Madagascar and enumerates the chief species composing them (according to the Rev. R. BARON, in the west there is scarcely 4 % of the plants to be found in the east). He then studies, with a historical review of the subject, the lumber trade of Madagascar, the timber itself and its uses, with its commercial value. Lastly he treats of the rubber and copal provided by the plants of Madagascar, and ends up with some considerations of a general kind on the increase and improvement of the forest production of the colony.

216 – **A Study on *Hibiscus tiliaceus*.** — HENRY (Technical Director of the "Société Française des Îles Marquises", at Jaiohae), in *Bulletin de la Société Nationale d'Acclimatation*, Year LXIIV, No. 11, pp. 343-345. Paris, Nov., 1919.

Hibiscus tiliaceus L. (= *Paritium tiliaceum* A. St. Hil. = the Burao of the Tahitians = the Hau of the Marquesans) is the, forest species in the islands of French Polynesia. It is to be found everywhere, in the valleys, on the highest summits, in damp places, in the driest parts, but it always indicates a fair degree of moisture in the subsoil when it is growing in places that appear on the surface to be arid.

Although the forms of this plant are comparatively varied, they appear to belong to a single species (even the *tricuspis* variety, which is doubtless only a dimorphic form, and another variety which is characterised by its wide polymorphy).

The uses of the wood of *Hibiscus tiliaceus* are comparable to those of walnut. It provides knee pieces of value in shipbuilding, and when seasoned it takes on a dark tint and provides a fine wood for cabinet making, especially the small-leaf varieties which have a finer grain and closer fibres. The young stems when ripened in the sun yield strong fibre suitable for making cheap cordage for home use. The wood varies in quality according to the shape of the leaf; the best and hardest is that from small-leaved trees whether they grow alone or along with other varieties.

These characteristics are constant, and generally the different varieties are found growing together in groups.

The *tricuspis* variety appears to be confined to Tahiti and to the Leeward Islands.

LIVE STOK AND BREEDING.

HYGIENE

217 – **The Toxicity of Cacao Husks for Livestock.** — MARCHADIER and GOUJON (Director and Chemist in the Laboratoire Municipal agréé du Mans), in *Annales des Falsifications et des Fraudes*, Year XII, No. 131-132, pp. 283-297. Paris, Sept.-Oct., 1919.

It is well known that the cacao fruit is a fleshy one, in whose pulp the seeds are set, the kernels of which are used in the manufacture of cocoa. The husk or shell of cacao is the perisperm of the seed. It is a membrane of no great thickness which completely surrounds the kernel and is very friable, especially when roasted, as is generally done in the case of husks used for stock feeding. Cacao husks are used on a large scale at the present day in the preparation of theobromine, an alkaloid much used since 1890 in the treatment of heart troubles. Besides this the husks also provide, on extraction with steam, cocoa extracts which are in great demand for confectionery aud which, on account of their high content of caffein, are used also in the manufacture of certain coffee substitutes, such as malt coffee. It is possible also to extract from them a brown colouring material soluble in alkalis and of a fast colour. Finally, as they have a high content of assimilable iron, the husks serve as a basis for certain medicinal preparations used for anaemia.

As regards the use of cacao husks for stock feeding, the authors declare that : —

1) The raw husks are dangerous, at least for horses, and the sale of them should be controlled.

2) The husks, when their extracts have been removed, are of no food value, and the sale of them for stock feeding should be forbidden.

218 – **Haemorrhagic Septicaemia.** — WASHBURN, H. J., in *U. S. Department of Agriculture, Bulletin* No. 674, pp. 9. Washington, May 15, 1918.

Bulletin dealing with the following points : — Characteristics of this disease ; History ; Causes ; Symptoms ; Anatomical changes which it causes ; Diagnosis ; Prevention ; Treatment ; Disinfection of premises.

Haemorrhagic septicaemia is an infectious disease which attacks various species of animals, especially cattle, sheep and pigs. Young animals are more susceptible to it than older ones; those which are thin and poorly nourished are most liable to infection. The disease is a poisoning of the blood which often rapidly proves fatal In suddenness of attack and high mortality at the beginning of an outbreak this disease much resembles anthrax.

In pigs the disease is called " swine plague " or contagious pleuropneumonia The acute form is usually fatal within a few hours from the appearance of the first symptoms. The acute form causes gradual weakening and emaciation and may last several weeks.

Fowl cholera is the form of haemorrhagic septicaemia affecting poultry ; it causes sometimes heavy losses among fowls, pigeons and geese. The outbreaks are generally so rapid in their effect that no treatment is possi-

sible. As soon as the disease appears the apparently healthy animals should inmediately be separated, placed in clean quarters and given good food and water. In many cases inoculating the healthy animals with Bacterins has proved effective in checking the spread of an epidemic.

In the United States haemorrhagic septicaemia occurred for the first time many years ago in the form of " swine plague ". In 1885, the Bureau of Animal Industry identified the *Bacillus bipolaris suisepticus* as the cause of the disease, identical with the " Schweineseuche " of German writers.

Curative treatment is useless. Preventive treatment by means of bacterins obtained from the same species as the animal to be treated (*B. bovisepticus* for cattle, *B. suisepticus* for pigs, etc), or else by means of an attenuated culture of the living organism, has often given satisfactory results. Isolation of the uninfected animals and disinfection of their quarters are most important measures.

219 – **Typhoid Fever and Infectious Anaemia of the Horse.** — Basset, J., in *Comptes rendus de la Société de Biologie*, Vol. LXXXII, No. 31, pp. 1262-1263. Paris, Dec. 6, 1919.

In previous papers (1) the author has shown : — 1) that typhoid fever in the horse is inoculable, being caused by a filtrable virus ; 2) that the virus is present in the blood, where it remains *in vitro* for over 15 weeks, and *in vivo* for about 5 months ; 3) that a first attack of the disease confers complete and immediate resistance *experimentally* for at least 4 months, and *clinically* for 18 months ; 4) that at the beginning the fever is present alone for 2 or 3 days, and that, consequently, in times of epidemic the thermometer serves to diagnose the start of the disease and ensures forthe patients the best chances of recovery.

As doctors and experimenters have been struck by the close similarity in the symptoms shown by horses affected with typhoid fever and those suffering from the acute form of anaemia, the author tried to find out if it were a case of distinct morbid entities and to compare them. Experiments on the subject show that : —

1) The two diseases are absolutely distinct ; 2) they are very different, because, contrary to typhoid fever, infectious anaemia is essentially chronic ; in the case of anaemia, as in the chronic forms of many diseases due to microbes (tuberculosis, farcy, malaria, etc.) the equilibrium of the organism is at the mercy of a more or less mild, common, or specific cause.

The author proposes to base on these experimental results a method for diagnosing anaemia. Dieases due to parasites visible in the blood having been eliminated, the diagnosis will be based on the remittence or intermittence of the fever. In the absence of spontaneous feverish attacks, these will be brought on by injection, into the blood, of serum from any horse (2).

(1) *Comptes rendus de l'Académie des Sciences*, August 21, 1911 ; *Recueil de med. vétér.*, Sept. 15, 1911, Feb. 15, 1912 ; *Bul. Soc. cent. med. vétér.* March 12, 1912. (*Authors' note*).

(2) And perhaps more simply by the injection of salt water in sufficient quantity (the author has at present no subjects on which he can verify this hypothesis). (*Authors' note*).

It is not at all necessary to bring about several attacks of fever; a single one *brought on*, appearing about 24 hours after the disturbing infection, will assure the diagnosis.

220 – **A Contribution to the Study of Anaplasmosis in Cattle: Sheep and Goats are Susceptible.** — IGNIÈRE, J., in *Bulletin de la Société de Pathologie exotique*, Year XII, No. 9, pp. 641-651. Paris, Nov. 12, 1919.

Inoculation experiments with *Anaplasma argentinum* on several species of animals showed that :—

1) The guinea pig, rabbit, pig and horse do not seem to be affected by *A. argentinum*.

2) Sheep and goats, on the contrary, are receptive to the parasite, which remains alive in the blood for years.

3) The passage from sheep to sheep or from one goat to another is possible indefinitely.

4) The inoculation with *A. argentinum* of sheep or goats never gives rise to symptoms or lesions of anaplasma, or to typical parasites visible in the red blood corpuscles ; the temperature is not altered, except sometimes about the 30th day, when a rise to 40-41° C. may be found for 1 or 2 days only ; even during this passing fever, when it exists, nothing abnormal is observed about the animal, and the blood colourations do not reveal *Anaplasma* as such ; the parasite, however, exists in the red corpuscules, as proved by inoculation, but the author thinks it is to be found there in so small a form that it is difficult to recognise.

5) The blood of sheep and goats previously inoculated with *A. argentinum* is active when injected into cattle which take anaplasma infection ; there is a posibility of attenuating the *A. argentinum* in the sheep and of using their blood as a vaccine against bovine anaplasmosis.

221 – **Curative Treatment of "Bush Sickness" by Iron Salts in New Zealand.** — REAKES, C. J. and ASTON, B. C., in *The New Zealand Journal of Agriculture*, Vol. XVIII, No. 4, pp. 193-197, 2 fig. Wellington, April 21, 1919.

The authors have made, at Mamaku Farm, a series of experiments consisting in giving medicinal compounds (either in the form of brick-licks or as drenches given by hand or in the drinking water) which contained elements known or suspected to be deficient in the local soil in the lands which caused "bush sickness" (1).

Summarizing the results obtained up to date it appears that, of the mineral preparations tested, the administration of phosphates, or iron salts to cattle grazed on pasture dressed with phosphates, keeps them in good health for a much longer period than would be the case without that treatment and dressing. But, on the other hand, it appears that it is only by drenching (by hand or in drinking water) with a syrup of phosphate of iron that the animals can be kept indefinitely in good health or cured of "bush sickness". Of organic compounds the double citrate of

(1) See *R.*, March, 1916, No. 316. (*Ed.*)

iron and ammonium cures " bush sickness " more quickly than syrup of phosphate of iron. It is probable that other organic salts of iron would be equally effective.

222 – **Observations on Avian Malaria.** — SERGENT, ÉTIENNE (Pasteur Institute of Algeria), in: I. *Bulletin de la Société de Pathologie exotique*, Year XII, No. 9, pp. 601-603. Paris, Nov. 12, 1919. — II *Do.* pp. 603-605. 1 diagr.

I. — It has always been agreed, with RUGE, that *Plasmodium* is pathogenic for the carrying insect to such an extent that, when experiments are to be made by infecting mosquitos with parasitised blood, care should be taken not to use birds very badly infected.

It appears, in fact, that when the insect shows on its stomach wall a certain number of cystic tumours as large as 60 μ (the stomach being on the average 1 500 μ long and 800 μ wide) these foreign bodies must cause some trouble in the functioning of its organism.

On the other hand, on the basis of the statement that insects fed on blood very rich in parasites are decimated by this excess of virus, it would be logical to believe that, following on a severe epidemic (e. g., with superabundance of blood-infecting *Plasmodium* of human malaria), there would be a diminution in the numbers of infected transmitting mosquitos, a thing which has never been clearly proved.

The author has found in the laboratory that *Plasmodium* is not very pathogenic for the insect carrying the virus. He observed several hundred cases of mass infection by *Plasmodium relictum*, an agent causing malaria in birds, in *Culex* of which each individual carried at least 100 zygotes at their maximum development ; he never observed a greater death rate among them than among the control *Culex* (i. e. those with only a few zygotes in their bodies) or among fresh *Culex* which had not been fed on *Plasmodium* infected blood. Hence the full development of *P. relictum* in *Culex* does not appear to involve disturbances fatal to the insect.

II. — In malaria of birds, after an incubation period of 3 to 10 days, there occurs an acute infection of the blood, during which *Plasmodium* is very prevalent for about a week. Then if the bird survives, the parasites quickly (in 3 or 6 days) become very rare. Some irregular attacks occur for a few weeks and precede final recovery or the state of latent infection which confers comparative immunity, without the parasites being visible in the peripheral blood.

After investigation, the author has found that in avian malaria the blood of the vertebrate is very infectious to the insect for the fortnight following the acute stage, in spite of the low number of parasites in the bird's blood during this period.

FEEDS AND FEEDING

223 – **Concentrated Cattle Foods used during the War.** — GUILLIN, R. (Report on work done in the Laboratory of the French Farmers' Society in 1917 and 1918), in *Bulletin de la Société des Agriculteurs de France*, pp. 173-174. Paris, June, 1919.

The subjoined table gives some interesting analyses of concentrated foods used during the war. A few unusual products will be noticed, which were resorted to on account of the shortage of foods.

Seaweed, washed and dried, has been used as fodder ; chestnuts have served as starchy food ; also bran from various grains has been utilised, some kinds of remarkable composition, others of little value.

Percentage composition of various cattle foods.

	Protein	Fats	Carbo-hydrates	Cellulose	Mineral matter	Water
Feeding Products of Good Quality.						
Oilseed Cakes.						
Groundnut cake	51.62	7.40	21.90	4.12	6.44	8.52
Copra »	20.84	13.80	39.28	12.08	4.72	9.28
Linseed »	30.62	6.92	36.14	7.30	6.88	12.14
Maize »	9.87	4.64	63.73	8.26	1.70	11.80
Palmnut »	16.50	9.16	47.40	12.54	3.94	11.46
Bran and milling residues.						
Cereal bran	14.18	3.60	54.08	10.44	5.40	12.30
Groundnut oily »	22.50	19.44	23.86	18.64	7.26	8.30
Soya »	9.90	1.00	32.09	40.56	4.70	11.75
Millet »	8.30	5.22	59.98	10.40	4.90	11.20
Buckwheat thirds	33.68	8.00	35.42	4.60	4.76	13.54
Various vegetable products.						
Seaweed	8.75	1.30	49.00	9.20	13.05	18.70
Kelp	12.50	1.20	45.46	9.60	15.00	16.24
Whole chestnuts	3.12	1.07	30.69	2.90	1.12	61.10
Coffee chicory husks	6.00	0.58	70.24	4.12	4.40	14.66
Dried beet pulp	8.65	1.20	58.21	17.80	4.22	9.92
Animal products.						
Fish meal (1)	39.75	2.10	—	—	43.22	12.46
» » (2)	45.80	9.50	—	—	14.00	30.70
Poor Food Products.						
Bean pods	6.68	0.34	43.22	34.84	3.16	11.76
Rice bran	5.08	0.64	36.88	32.24	16.12	9.04
Buckwheat bran	7.15	1.16	44.19	30.60	2.60	14.80

(1) Sodium chloride 0.24 % ; phosphoric acid 15.74 % ; lime 20.20 %.
(2) Phosphoric acid 5.76 % ; lime 7.70 %.

The table also shows the composition of dried coffee chicory husks. Coffee chicory is subject to fairly considerable variations in price ; some years, in consequence of super-abundance, there is a fall such that selling does not pay and even is very difficult. In that case, husks of coffee chicory can be used as cattle food ; they constitute a good carbohydrate food, of similar feeding value to sugar beet, although in the chicory root synanthrose predominates instead of saccharose, as in the artichoke.

BREEDING

224 – **Results of Crossing the Zebu with European and Australian Cattle, in British and Dutch India.** — T'Hoen, in *Cultura, Officiel Orgaan van het Nederlandsch Genootschap voor Landbouwwetenshap*, Year XXXI, No. 374, pp. 369-374 + 5 figs. Wageningen, Nov. 1919.

In tropical colonies, repeated of attempts have already been made to cross *Bos taurus* with the zebu, so as to combine the beefproducing capacity and productivity of the former with the adaptability of the latter to the local conditions and its special resistance to disease.

The author describes the results of a series of crosses between the Neellore breed of zebu on the one hand and the Java ox and some European and Australian cattle on the other hand.

The zebu of Neelolre (Madras, British India) is an excellent working animal ; it measures 1.40 to 1.50 metres at the withers ; the female gives a high yield of milk, 8-10 litres per day with a fat content of 4.5 to 5 per cent. From the cross zebu × Java cattle, draught types were obtained but they were poor milkers. By crossing Neellore zebus with Australian or Dutch cattle, animals were obtained which gave a good production of beef and a milk yield which, although less than that of their European dams, was nevertheless above that of the zebus, and such as to make these hybrids of great value in the warm damp coast regions of the Dutch East Indies. The fat content of their milk is 4 % and even over. The castrated males make splendid draught animals ; the author mentions a pair (sold on the Malang market) which measured each 1.50 metres in height and 2.20 metres round the chest.

By using as sires, in these crosses, males of European breed, the zebu characteristics quickly disappear, and in the 3rd generation the progeny cannot be distinguished from pure-bred European cattle.

The importation of bulls and dairy cows from India, Europe and Australia is regulated by the State. The European and Australian types concentrated in the central mountainous territory, where the altitude moderates the temperature and keeps it between 15° and 30° C., can become acclimatised and breed regularly.

The results already given by scattered and un-coordinated attempts promise the best of prospects for the future, especially when the work is carried on according to a uniform method and with a well-planned programme of work.

The example of British India, gives an idea of the results that can really be obtained by the crosses in question. The Montgomery (Zebu) cow has been mated with the Ayrshire bull, with a view to raising the milk yield of the zebu type. While the Montgomery cow yields on an average 8-10 litres of milk per day, at the second generation of the cross a daily yield of 15 litres has been attained.

STOCK RAISING AND ENCOURAGEMENTS

225 – **Domestic Animals in Syria.** — Dechambre, Ed., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 29, pp. 975-976 and 995-1002. Paris, Dec. 17, 1919.

The author (Veterinary Adjutant-Major with the French troops in the Levant) has studied the different aspects of animal production in Syria.

The contour of Syria is very varied ; it includes high mountains like Lebanon and Anti-Lebanon, and vast plains like the Beka, which stretches between the above two ranges.

Except for some parts of the Beka plain, the neighbourhood of the towns and a part of Lebanon, the country is badly cultivated. The soil is fertile in many parts, but suffers from lack of water. In fact, during the whole summer, from April to November, there is no rainfall and the drought is extreme ; growth is practically at a standstill and the ground is covered only with hard dried grasses, mostly spiny. Only in spring is vegetation luxuriant, and many herds are fed on it.

Livestock is one of the main sources of this country's wealth, but on account of the difficult conditions under which it subsists, improved breeds cannot be found there.

Exact figures as to the numbers of animals are not available, the only statistics on the subject dating from 1895.

Cattle. — The type is uniform, constituting a true breed, and has great similarity to that of Lower Egypt, but is rather more developed. The height is small (1.15 to 1.30 metres on the average) ; head rectilinear, nape somewhat prominent ; horns always very short, growing sideways and upwards, turned down only in some cases ; neck short, dewlap much developed ; back straight, rump short, thigh rectilinear, udder very small, sometimes scarcely visible between the hind legs ; colour dark fawn with some white spots ; bulls almost black with shades of fawn on forehead, nape and back ; hair rough, skin thick ; they hardly ever handle well, as there is no covering fat, even on animals in condition ; internal fat scarce, located about the loins. The cows give little more than 80 kg. of meat net, and hardly ever as much as 100 kg.

In the Damascus region much more developed, specimens are to be seen but their race characteristics are similar.

There are also somewhat larger cattle light grey, ash-coloured, and with fairly long turned-up horns. These are likely cattle from the north ; they are similar to the animals seen at Smryna and Constantinople.

Sheep. — These form one of the sources of the wealth of Syria. Unlike cattle, they grow very well on the immense plains that are covered with numerous flocks.

In general the size is fairly large ; the tail is very big, loaded with fat, and quite unlike that of the Barbary sheep (large mass as wide as the back, often reaching to below the hocks, then turning sharply back and upwards, narrowing a little, and ending in a loose part, 20 to 25 cm. long, like the tail of a European sheep) ; generally no horns ; when they are present they are short and turned backwards ; some specimens have very long spiral horns (40-45 cm.) at both sides of the head ; colour white with some brown or black spots, but the colouring may extend over all the head and even a large part of the body. The wool does not cover the face and does not come past the knees or hocks ; it is not too coarse, 7-8 cm. long, wavy and somewhat curly ; the fleece is not thick.

In the south of Palestine, very large sheep are found, without horns,

with long black fleece, tail very big but conical and elongated. These supply almost all the local consumption needs. Their flesh is of fine quality but almost always has a strong disagreeable odour.

Goats. — These are extremely numerous all over Syria, and in many parts fom larger flocks than the sheep.

The type is less uniform and less charactersistic than that of sheep and cattle. There are two distinct breeds, but these are frequently cross bred : —

1) A breed of fairly big goats with very long ears, without horns (or with very small ones turned backwards), of black colour more or less marked with white, with hair very long (15-20 cm.), stiff and hardly waved, udder much developed. This breed is excellent for milk. It is the same breed as is found round about Beyrut, which it supplies with the greater part of the milk consumed there.

2) The immense flocks of goats on the plains of the interior are of a quite different type. The size is less developed, ears are small, and erect, and horns long, in elongated spirals at each side of the head. The coat is black with some white spots. The fleece is shorter than that of the other breed.

Horses. — The number of head is much lower than for the preceding classes. Syrian horses enjoy a worldwide reputation, but requisitions by the Turks have spoiled their future.

These horses are of small size, spare, and muscular, the coat is very light grey, often spotted, or chestnut ; the face has a slight dip in the su pranasal bones.

At Damascus there are horses which correspond better with the clas sic type of Arab horse : big, generally bay, rectilinear outline, face flat supranasal bones not dished, nostrils widely opened and squarely cut

Mules. — These are fairly numerous, of good size, muscular, re sistant, used almost entirely for the pack saddle.

Donkeys. — Very numerous ; small, like those of North Africa at Damascus, a large proportion have absolutely white coats.

Camels. — Much used for transport ; of the humped species numbers reduced by requisitions of the Turks.

Poultry. — Very abundant everywhere. Fowls are of sma size, as large as good partridges ; the plumage is mottled white, red an maroon. Before the war Syria exported a large quantity of dried egg

Like all poor and arid countries, Syria is a country where only shee and goats can thrive. It is likely that France might be able to utilise thes appreciable resources. The native consumption is not sufficient to re quire the Syrian flocks. If the Arabs continue rearing without good ou lets for their products, it is because, for them, flocks constitute a visibl sign of wealth. It is not even doubtful that they would agree to dispos of their stocks for gold or silver.

In regard to cattle, it would be best to consider them entirely as draugl animals and use them for agricultural work. When methods of cultivatio become improved and when crops become more abundant and more r

gular, then the grading-up of the herds of cattle will be able to be taken in hand. For this purpose, selection of the native breeds or the introduction of French breeds may be resorted to. It will be advisable, however, to be careful in using the latter method. In order to avoid much loss of time and costly failure, it will be wise to take into account the results to be got by this method, under similar conditions, in North Africa, in Tunis and especially in Morocco.

226 – **The Distribution of High-Class Breeding Stock by the Government, in Saskatchewan, Canada, from 1913 to 1918.** — *The Agricultural Gazette of Canada*, Vol. 6, No. 11, p. 978. Ottava, Nov., 1919.

The Live Stock Branch of the Department of Agriculture for Saskatchewan has published returns on the working of the Live Stock Products and Sale Act. The returns show the net results of the efforts of the government to introduce by means of this new law pure bred and high class grade stock into Saskatchewan. The totals under the different classes of stock show a very satisfactory increase from the year when the law came into force (1913) up to 1919.

In all, 17 261 breeding animals have been supplied to 2 067 farmers on favourable conditions. Table I shows the complete record of animals supplied by the Department since the year when the act first came into operation, and Table II shows the number of farmers who have taken advantage of the assistance and facilities offered by the Department in virtue of this act.

TABLE I. — *Numbers of breeding animals distributed by the Government between* 1913 *and* 1918.

Years	Pure-bred bulls	Pure-bred cows	Grade cows and heifers	Pure-bred rams	Grade ewes	Swine	Total animals
1913	19	18	345	—	1000	—	**1382**
1914	41	14	483	13	482	2	**1035**
1915	84	12	368	35	2120	3	**2622**
1916	150	6	342	10	852	—	**1360**
1917	158	10	1322	33	2968	283	**4774**
1918	135	7	1725	127	4061	33	**6088**
	587	**67**	**4585**	**218**	**11 483**	**321**	**17 261**

TABLE II. — *Numbers of farmers who have taken advantage of the facilities afforded by the act.*

Number of purchasers	1913	1914	1915	1916	1917	1918	Total
of cattle.	127	163	184	243	356	310	**1383**
of sheep	—	18	52	30	101	162	**363**
of pigs	—	2	3	—	283	33	**321**

HORSES AND MULES

227 – **The Service of State Stallions in Italy during 1919.** — MORESCHI, B., in *Giornale di Agricoltura della Domenica*, Year XXIX, No. 37, p. 269, Piacenza, Sept. 14, 1919.

At the end of July, 1919, the State stallions had served 62 977 mares, distributed as follows among the districts belonging to the different centres : Crema — 15 857 ; Ferrara 10 850 ; Santa Maria di Capua 9 815 ; Reggio Emilia 7 815 ; Ozieri 8 670 ; Pisa 5460 ; Catania 5384. As the stallions, contrary to regulations, continued to be used after this date in many districts, the above figures will have to be slightly modified. The total number of mares served in 1916 by government sires was 46 033. Hence there is a considerable increase in the last few years ; in Sardinia it amounted to 50 % from 1918 to 1919. Estimating the number of stallions in service during 1919 at 1 110, each of them them served on the average, 57 mares.

228 – **Mules in French West Africa.** — LOYER, M., in *Bulletin de la Société Nationale d'Acclimatation*, Year LXVII, No. 11, pp. 332-233. Paris, Nov., 1919.

The substitution of animal traction for human porterage is of great economic and social importance in French West Africa.

A mule yoked to a light cart is capable of transporting 500 kg., or the loads of 20 men (a man's load is 25 kg. for 25 kilometres per day, on the average). It costs in food only 25 centimes per day and hiring charges come to 1 franc per day at most, with food and attention included. A mule driver in charge of 3 mules and 3 carts will cost 1 franc (men porters cost from 90 centimes to 1 franc per day, including their return journey).

Mules alone can serve for this purpose, as the African horse is no good for draught on account of its breed, and oxen can take only 100 kg. and do not stand up to long journeys.

Under such conditions it is necessary to breed mules fit to fulfill the conditions of transport in West Africa, and the selection of stallions should be specially investigated. The Poitou jack donkey must be discarded, as it gives a mule that is slow, heavy, too big, a bad resister of heat and one troubled with hoof splitting ; the Pyrenees jack must also be discarded, although it would give a mule of the desired size. The most suitable mule is the medium artillery one, sired by the Spanish or Moroccan jack ; it is of small size and is not liable to foot troubles.

In Africa, the mule exists only accidentally (1) as the natives, although they greatly appreciate the animal, refuse to breed it deliberately under the belief that it is the result of a mating contrary to nature.

It is necessary to breed mules on the spot, because those sent to French West Africa are too expensive. There are suitable animals in French W. Africa, especially in the Volta basin, but service is difficult, as the native jack is indifferent. On the other hand, the European jack donkey and the Moroccan which have already served do not give rise to this inconvenience.

(1) The latest census in French W. Africa (1912) gives 116 000 horses, 7 800 000 cattle, 5 500 000 goats, and 4 500 000 sheep, but mules are not mentioned. — See *R.*, Feb., 1919, No. 146. (*Ed.*)

To the advantages to be gained by using mules for transport must be added those that would be provided in ploughing, which neither oxen nor horses can manage in tropical countries.

CATTLE

229 – **The " Maoilin " Breed of Cattle in Ireland.** — MITCHELL, S. L., in *Hoard's Dairyman* Vol. LVII, No. 11, p. 551, Fort Atkinson, April. 4, 1919.

The Irish " Maoilin " breed of cattle, hornless, with dark brown yellow coat, generally whole coloured sometimes spotted white on the head and shoulders, is very ancient and at the present time there are only 8 or 9 herds. Several skulls of animals of this breed have been found in the " crannogues " (1).

According to some writers, the native home of this breed stretches east of the Shannon through Longford, Westmeath, Kings County and Tipperary ; at the present time it is found chiefly in the west part of the island from Donegal to Cork. The distinctness of the breed is shown by the fact that, however much crossed, it is dominant and recognisable even to the 10 th. generation. It is due to this fact that the breed is not to day entirely extinct. A society has been formed for re-establishing this breed.

" Maoilin " cows are excellent milkers ; they give from 8 to 10 gallons a day in summer and 4 or 5 gallons a day in winter of delicious rich milk. They are not liable to any disease. According to the author the hornless character of some of the present Scotch and English breeds may be due to cattle introduced into East Anglia and Scotland by early Irish colonists.

230 – **Inheritance of Quantity and Quality of Milk Production in Dairy Cows.** — CASTLE, W. E., in *Proceedings of the National Academy of Sciences of the United States of America*, Vol V, No. 10, pp. 428-434. Washington, October, 1919.

In 1911, Mr. T. J. BOWLKER undertook, at his farm in Framingham (Massachusetts), an experimental study on a large scale of inheritance in dairy cows by the modern method of crossing pure breeds and looking for a combination, in the 2nd crossbred generation, of the characters differentiating the breeds used in crossing. The breeds which he selected for trial were the Holstein-Friesian (which surpasses all others in the quantity of milk produced) and the Guernsey, which is distinguished for the quality of its milk. He started with the idea that, if the quantity and quality of milk production were independently inherited characters, it should be possible to combine them in a single breed by crossbreeding, in accordance with MENDEL's laws. The experiments were continued at Framingham up to 1919, and will be carried on by the University of Illinois.

The Holstein cows were mated with a Guernsey bull and the Guernsey cows with a Holstein bull. Altogether, between 1912 and 1919, 140 F_1 calves were produced ; by mating F_1 heifers with F_1 bulls, 35 living F_2 calves were obtained, all vigorous and well grown. The F_1 cows calved

(1) The Irish name for a kind of blockhouse used in ancient times as fortresses by Irish chiefs and which were generally built on islands. — Cf. *Nouveau Larousse illustré*. Paris, Librairie Larousse. (*Ed.*)

for the first time at a slightly earlier age than the cows of either pure breed, which is evidence of their vigour and early maturity.

The following data have been taken from the tables showing the milk and butter-fat production for the 1st and 2nd lactation periods of the pure bred cows and of those crossbred :—

Milk and butter-fat production of cows of pure Holstein and Guernsey breeds and of cows bred by crossing them.

Breed	Number of Cows	Average age at calving	Average quantity of milk produced	Percentage of butter-fat	Average quantity of butter-fat produced
		1st. lactation period.			
Holstein	25	2.8 years	7 673 lb.	3.4	261 lb.
Guernsey	8	2.7	4 617	5.0	230
F_1 crossbred	31	2.6	6 612	4.08	270
		2nd. lactation period.			
Holstein	20	4 years	9 475 lb.	—	322 lb.
Guernsey	8	3.8	5 593	—	280
F_1 crossbred	13	3.9	8 663	—	363

In the 1st lactation period, and still more in the 2nd, the F_1 crossbred cows gave results superior to the mean between the results given by the pure breeds producing them both as regards the quantity of milk and fat. But the record of variations relatively to the mean in the case of F_2 crossbred cows must be awaited, unless the quality and the quantity of milk production are transmitted by independent factors ; in that case it should be possible to combine them and to obtain inheritance transmission.

The two reciprocal crosses differed very slightly, and inversely in the two lactation periods ; it seems, therefore, unlikely that any sex-linked factors are concerned.

231 – **Cattle Feeding Investigations in Kansas, U. S. A.** — *Kansas Agricultural Experiment Station, Report for the year* 1917, pp. 28, 29, 39, 40. Manhattan, 1918 ; *Report for the Year* 1918, pp. 40-42. 1919.

Eighty-four grade Hereford calves from the Fort Hays agricultural substation were divided into six lots and full-fed for the production of yearling beef. Four lots were used to compare good sweet-clover hay and green, brown and black alfalfa hay. The concentrates used were shelled maize and oil meal. The black alfalfa had been stacked immediately after cutting without being cured. It was charged at $5 per ton, whereas the price of the other hays was put at $15.

The black-alfalfa lot was given almost twice as much hay as the other lots but ate somewhat less grain. The gain averaged lowest and was the most expensive of any lot with grain. The green-alfalfa hay lot made

slightly better and more economical gains than the brown-alfalfa lot. The lot fed with sweet clover hay made about the same gains as the green-alfalfa hay lot, but these were cheapest.

The two remaining lots were used to compare ground maize, barley, and linseed meal with shelled maize and linseed meal when the roughage consisted of brown alfalfa and silage in both cases. The maize and barley lot made the fastest gains of any of the six lots, but next to the black-alfalfa lot these were the most expensive. The other lot made rather low but cheap gains.

Progress is reported on a project at the Fort Hays sub-station concerning the development of breeding heifers. During the second winter of the experiment the cows which had calved at 3 years made better gains than the group that calved the succeeding spring as two-year olds. In both groups the lots receiving maize and cotton-seed cake in addition to roughage averaged somewhat less than twice the gain of lots fed with only alfalfa hay silage and wheat straw, but at somewhat more than twice the cost In the case of 2-year olds, the grain-fed lot had less trouble in calving.

At the Kansas agricultural station at Manhattan, 5 lots, each consisting of 6 steers and 4 spayed heifers were fed 5 months in winter for the production of " baby beef ". The check lot received the following approximate daily ration: — shelled maize 10 lb., linseed meal 1.7 lb., immature maize and Kafir corn silage 10 lb. and alfalfa hay 4.5 lb. ; the others received some variant of this. A ration in which the maize was ground produced slightly greater gains and more finish than the check ration and the added profit more than offset the cost of grinding. A lot receiving cottonseed meal instead of linseed meal showed inferior finish, although the gains were only slightly decreased. Until the end of the third month the calves receiving cotton seed meal had gained more than any other lot and showed as much finish, but after that time cottonseed meal did not seem to stimulate the appetite in the same way as linseed meal, with the result that they would not eat as much feed and could not make the gains.

A lot receiving no silage but nearly doubling the alfalfa consumption of the check lot, made the least profit per calf of any lot, due partly to the difference in prices charged for alfalfa and silage, and partly to lower gains. A lot receiving neither silage nor supplement but over twice the check ration of alfalfa made the slowest gains of any lot and next to the lowest profits.

232 – Comparison between Rape and Bluegrass as Pasture for Fattening Lambs, in Kentucky, U. S. — HORLACHER, L. F., in *Breeders Gazette*, Vol. LXXV, No. 26, p. 1508 and 1510 Chicago June 26, 1919. SHEEP AND GOATS

In an experiment made at the Kentucky Experiment Station the author has compared rape and bluegrass (*Poa pratensis*) as forage crops for fattening lambs. The lambs sucked their mothers at night and morning ; during the day they were separated from the ewes and placed in the pasture ; they were also given half a pound of a mixture of oats and bran, in the proportion of 2 : 1 per head per day. The test lasted 42 days commencing

each on June 20 1918. One lot of 10 lambs was placed on an acre of bluegrass (which had not been previously pastured) ; their average initial live weight was 62.3 lb. ; they had an average daily gain in live weight of 0.3 lb. per head and they consumed 1,9lb. of grain per pound of gain.

Another lot of 10 lambs which was placed on an acre of Dwarf Essex rape, had a average initial weight of 59,4 lb ; the gain in live weight was 0,38 lb. per head daily ; this lot only required 1,6 lb. of grain to produce an increase of 1 lb of live weight and were in better condition and more appreciated on the market than the other lot.

During the first two weeks of the test, the lambs placed in the rape fields scarcely touched it,with the result that the lambs feeding on the bluegrass made almost double the gain in live weight that was made by those on rape. By the middle of July the pastures were getting dry : the bluegrass was still good for forage, but it was short and brown ; the rape was turning brown and yellow. At the end of the 4th week the lambs on rape had regained, in comparison with those on bluegrass, all that they had lost at the beginning and had taken the lead. The 5th week was constantly wet, which freshened the pastures, and the difference in favour of the rape was therefore not so marked as it would have been if the season had continued normal.

233 – **Goat and Sheep Rearing in Brazil.**— in *Bulletin Commercial de la Section des Affaires économiques et commerciales du Ministère des Relations extérieures*, No. 4, p. 19, Rio de Janeiro, October, 1918. (Contributed by Prof. DEOCLECIO DE CAMPOS, Delegate for to the International Institute of Agriculture).

Brazil is admirably suited for goat and sheep rearing. According to the estimate made in 1916, Brazil possesses 6 919 550 goats, distributed in the different States as follows :—

Alagoas	251 680	goats
Amazonas	7 640	»
Bahia	2 779 820	»
Ceará	464 740	»
Federal District	5 500	»
Espirito Santo	44 980	»
Goyaz	83 800	»
Maranhão	218 060	»
Matto Grosso	18 810	»
Minas Geraes	426 330	»
Pará	17 820	»
Parahyba	841 100	»
Paraná	67 770	»
Pernambuco	710 830	»
Piauhy	420 820	»
Rio de Janeiro	89 670	»
Rio Grande do Norte	352 000	»
Rio Grande do Sul	76 280	»
Santa Catharina	19 039	»
São Paulo	364 601	»
Sergipe	174 680	»
Territory of Acre	1 260	»
Total . . .	**6 919 550**	goats

Brazil occupies the second place in the list of countries which possess herds of goats, as may be seen from the following table :—

Union of South Africa	11 520 744	goats
Brazil.	**6 919 550**	»
Argentina	3 945 986	»
Algeria	3 772 424	»
Germany	3 438 290	»
Spain	3 116 238	»
Austria-Hungary	3 014 190	»
Italy	2 714 828	»
Bulgaria	1 459 344	»
France	1 230 238	»
Portugal	1 034 218	»
Serbia	630 579	»
Tunisia	499 164	»
Switzerland	358 093	»
Chile	288 056	»
Norway	240 303	»
Netherlands	232 478	»
Belgium	217 823	»
Japan	89 488	»
Sweden	71 054	»
Uruguay	19 951	»

Of *sheep* Brazil in 1916 possessd 7 204 920, distributed as follows among the different States :—

Alagoas	183 530	sheep
Amazonas	12 810	»
Bahia	1 841 900	»
Ceará	320 950	»
Federal District	3 020	»
Espirito Santo	36 260	»
Goyaz	78 040	»
Maranhão	84 820	»
Matto Grosso	47 530	»
Pará	33 570	»
Parahyba	189 560	»
Paraná	79 200	»
Pernambuco	356 520	»
Piauhy	256 060	»
Rio de Janeiro	63 510	»
Rio Grande do Norte	207 510	»
Rio Grande do Sul	2 622 920	»
Santa Catharina	29 770	»
São Paulo	149 470	»
Sergipe	145 460	»
Territory of Acre	2 049	»
Total	**7 204 920**	sheep

Although the country is second in the world for its number of goats it has not yet reached an outstanding position for its sheep.

The chief sheep-rearing countries are listed below, in order of importance for numbers (before the war):—

Australia	85 057 402	ovini
Argentina	83 546 000	»
United States	48 483 000	»
Russia in Europe	42 735 657	»
Union of South Africa	35 710 843	»
United Kingdom	28 181 540	»
Uruguay	26 286 296	»
New Zealand	24 788 150	»
Spain	15 829 951	»
Russia in Asia	14 519 629	»
Austria-Hungary	12 337 542	»
France	12 079 211	»
Italy	11 162 962	»
Bulgaria	8 633 388	»
Algeria	8338 023	»
Brazil	**7 204 920**	»
Germany	5 073 478	»
Chile	4 577 194	»
Serbia	3 818 997	»
Portugal	3 072 988	»
Norway	1 329 559	»
Canada	1 265 101	»
Tunisia	1 119 310	»
Sweden	988 163	»
Netherlands	842 018	»
Denmark	254 428	»
Belgium	185 373	»
Switzerland	171 635	»

Recently the Federal Government of Brazil, recognising that this branch of the industry was not by itself attaining the importance which the splendid natural conditions of the country could confer on it, promulgated a Decree which granted various favours specially to the breeders. The following are some of the provisions made:

Decree of February 27, 1917. — Art. 1. — The Government, with the aim of encouraging and developing sheep and goat breeding, will assist the States, Municipalities, Agricultural and Breeding Societies, Animal research stations and private individuals, when approved as perfectly suitable, by granting them the following favours:

a) Payment of a sum equivalent to ⅓ of the purchase price and of transport charges on breeding animals of the two species in question purchased abroad, up to a maximum of 25 animals of both sexes for each breeder.

b) Payment of the amount of 15 *paper milreis* (1) per animal imported and transport inside the country for breeding ewes up to 1000 head.

(1) 1 *paper milreis* = 1s.: 4 *d. at par.* (*Ed.*)

c) Pure-bred ewes or she-goats and rams for breeding, in excess of the number of head mentioned under *a*), will give the right to the benefits indicated in *b*) up to 1000 head in number. —

Art 2 — In order to obtain the above benefits the interested parties will have to prove :

1) That the extent of the land destined for rearing is in the proportion of 1 hectare to every 4 head.

2) That the land is dry and loamy.

3) That the fields are well cleared and no thorns liable to spoil the wool are to be found in them.

4) That they possess abundant and suitable fodder.

5) That they have a supply of pure running water.

6) That they are situated in a dry temperate climate.

7) That they have to hand suitable equipment, such as folds, diping troughs, places for storing and preparing wool.

8) That the regulations of the health authorities have been observed at the time of importation and that the animals imported are not under one year and a half or over three years of age.

Art. 3. — All regulations to the contrary are abrogated.

Foreign Trade. — In 1916, Brazil exported 326 sheep to the value of 4 651 *paper milreis* and in 1917, 126 to the value of 2 600 *paper milreis.*

In 1916 Brazil imported two goats, worth 253 *paper milreis,* and in 1917, 6 animals worth 729 *paper milreis.*

In 1916, the import of sheep was 1412 head valued at 187 091 *paper milreis,* and in 1917, 3 409 head valued at 247 059 *paper milreis.*

All these imported animals are pure stock for breeding.

234 - **The Breeding of "Kamcik" Pigs in Eastern Bulgaria.** — Gancev, G., in *Zemledielsko-Skotovodsto,* Year II, No. 7-8, pp. 154-158. Sofia, Sept.-Oct. 1919 (1). PIGS

With the exception of some unsystematic attempts at crossing with Berkshire, Yorkshire and Mongolitza breeds, all the pigs bred on a large scale in Bulgaria are of native origin. The "Balkanic" breed predominates but it contains local types differing slightly from one another according to the climatic, topographic and feeding conditions of each zone.

(1) In his work entitled *Le razze bovine e suine della Serbia* (Bologna, 1918) E. Mascheroni states that the improvement of native pigs in Bulgaria dates back to 1884. In that year English breeding animals, Yorkshires and Berkshires, began to be introduced, and the Government estabilshed piggeries with boars and sows at the schools of agriculture and at the stud stations. Only in 1906 were piggeries set up (at Kaja-Bouroum and Kula with a view to improving the native breed by crossing with the Mongolitza. The latter seems most suitable for crossing with the native Bulgarian pig, and it could not be otherwise, as pig breeding there is very different from that practised in England : the feed of Bulgarian pigs, and generally of all pigs in the Balkan peninsula, consists mainly of pasturage.

In Serbia, where the native pig belongs to the Balkan breed (the same as most of the pigs in Bulgaria), crossing with the Mongolitza pig has always given good results. The *Matchva* and the black *Morava* pig are improved by crossing with the Mongolitza. Even the Serbian half-wild mountain pigs (*Kostrechke* and *Konjari*) when cross bred with the Mongolitza give excellent progeny.

The Kamčík pig (Kamčüska Svinka) belongs to one of these types. In the valleys watered by the large and the small Kamčik, pig breeding has become a commercial affair. Every household rears from 5 to 20 of these animals and people owning up to 200 are not rare. The chief breeding centres are the villages of Smiedovo, Zlokuceni, Cenge, Novo-Selo, Kopriі-Khoi, Goren Ciflik, Arnautlar, Staro-Oriekhovo, etc., situated in the districts of Varna, Prieslav and Pravadia (Eastern Bulgaria).

The Kamčik breed has some wild blood, as wild pigs, which are still fairly numerous in the more mountainous and out-of-the-way districts, sometimes mingle with herds of domestic pigs and stay there for a time. Also, new-born pigs have on either flank dark transversal markings, disappearing with age, which are characteristic of the Balkan wild pigs.

The Kamčik is of medium size : at one year old it is 60-70 cm. high and 0.80- 1 metre in length. It is black in colour, with white and black or yellowish spots. Well-fed specimens at 1 year weigh 80 to 100 kilograms, and with age may reach 150 kg. The pork is very good and the yield on the average is from 45 to 50 per cent.

For the greater part of the year the pigs live in the open in herds, mainly in the great oak forests where they find plenty of acorns, roots and excellent pasture. At 1 year they are fed for fattening, which lasts in all 30-40 days and consists for the first half of the time of acorns, and for the second half, of maize.

Beside so many excellent qualities from the local economic point of view, the native pigs of Bulgaria have the fault of being too small and too short. Hence the author urges the advisability of improvement by cross breeding. The Mongolitza breed would be suitable for this purpose.

235 - **Mineral Nutrients and Maize in Swine Feeding in Kansas U. S. A.** — *Kansas Agricultural Experiment Station Report for the Year* 1917, pp. 13-15. Manhattan, 1918 ; *Report for the y ear* 1918, p. 13. 1919.

In order to study the importance of mineral nutrients in swine feeding, 90 Duroc-Jersey pigs were divided into 15 lots and fed on maize, with various ash and protein supplements. Bone ash was a valuable addition to all rations tried, except those containing tankage, when it proved detrimental. A ration of maize meal and alfalfa pasture did not supply all the mineral required for young fattening pigs.

Six pregnant Duroc-Jersey sows, fed on maize only, and three fed on a similar low ash ration composed of ground maize, wheat gluten, and blood meal produced small litters of poorly developed pigs, half of which were dead in 30 days. The sows were generally in poor condition, and two died about 5 weeks after farrowing. Two control lots, comprising 3 sows each, were fed on a mixture of ground maize 70 parts, shorts 24 parts and tankage 6 parts with or without extra mineral matter, and produced healthier pigs that grew more vigorously and showed a lower death rate.

Study of the influence of low-ash rations on pregnant sows was made in 1918 with 14 animals, 10 being survivors of the preceding year's work. Eight sows fed on ground maize alone either tap or distilled water pro-

uced 14 dead pigs and 39 living ones, of which only 6 lived for 2 months. hree sows fed on maize, maize gluten meal and blood meal produced 21 ead pigs and no living ones. Three sows fed on maize, shorts and tankage roduced 1 dead pig and 21 living ones, all still alive at weaning, 60 ays afterwards.

Study of the effect of protein and ash supplements to maize in the fat- ning ration was made with 66 Duroc-Jersey pigs weighing at the start bout 45 lb. a head and divided into lots of 6 each. The feeding methods re judged largely by the time necessary for the pigs to gain 150 lb.

Seven lots were fed on alfalfa pasture, and 4 in dry lots. Of the 7 for- er, the 3 lots in which maize was the only concentrate took longest (104 to 07 days) to attain the desired weight. Additional ash had no apparent fluence. The most rapid gains (97 days) were made by a lot given % of the concentrate as tankage and which had access to extra mineral utrients. A lot in which shorts and tankage (4 : 1) formed 20 % of the rain ration gained 150 lb. per head in 99 days. Two self-fed lots, one with aize, shorts and tankage and the other with maize, tankage and additional sh, required 100 and 101 days respectively. Three of the lots not on asture received shorts and tankage (4 : 1) as supplement to maize. A feed- g period of 112 days was required for two whose grain rations were 70 nd 60 % maize, respectively, and a period of 105 days for the other in hose ration the proportion of maize was gradually changed from 40 o 80 per cent. The fourth lot not on pasture had free choice of maize, horts and tankage and needed 104 days' feeding. Shorts and tankage ere consumed approximately in the proportion 8 : 1 and formed bout 30 % of the ration.

6 – **The Influence of Groundnuts and Rice Bran on the Quality of Pork: Experiments in Texas, U. S. A.** — Burk, L. B., *Texas Agricultural Experiment Station Bulletin* 224, pp. 5-13. 1 fig. College Station, January, 1918.

The purposes of this experiment were to determine : — 1) The value groundnuts as hog feed ; 2) the kind of pork that groundnuts will roduce ; 3) whether soft oily pork can be profitably hardened by feeding grain ration ; 4) whether or not hogs can be prevented from getting soft hen grazing on groundnuts by feeding a half grain ration ; 5) the kind of ork produced by milo maize and rice bran ; 6) the feeding value of the fferent rations.

The experiment involved 12 lots of 10 pigs each, averaging 107 lb. r head. The different lots were under observation at varying intervals, etween October 12, 1916 and January 19, 1917. For 20 days or more revious to the experimental periods all the hogs were fed on a balanced ain ration of milo maize chop and meat meal. All the lots except Nos. 1, 11 and 12 grazed on groundnuts or were fed on groundnuts in dry lots.

The hogs grazing on groundnuts produced an average of 158 lb. of pork r acre, the estimated yield of groundnuts being 19 bushels. The oundnut-fed hogs that were finished on grain were changed gradually om groundnuts in order to prevent the animals from going off feed. The

success of this method is indicated by the fact that every lot made its best gains during the week of the change. The lots on cottonseed meal and milo maize were fed for 80 days without any signs of cottonseed meal poisoning.

Some of the results of the feeding and slaughtering tests are given below.

At the beginning of the test two, hogs from a check lot were slaughtered and placed in a cooler temperature held at 32°F. After 24 hours they were firm. At the end of 40 days four hogs that had grazed with lot 8 on groundnuts were slaughtered and held at freezing temperature. These carcasses were soft and oily both after 24 and 48 hours of cooling. At the end of the experiments the hogs were sold to a packing house in Fort Worth, Texas, subject to a killing test. They were examined after being held in the coolers for 24 hours at from 32 to 38°. The results of this examination are given in the following table.

Effect of groundnuts and rice bran on pork.

Lot	Ration: Grazing crop	Ration: Grain		Daily gains per head: On pea-nuts	Daily gains per head: On dry lot	Feed per pound of gain	Shrinkage in shipping	Condition of carcass after 24 hours in cooler: Firm	Condition of carcass after 24 hours in cooler: Oily
				Lb.	Lb.	Lb.	%	No. of hogs	No. of hogs
I	—	Milo chop.	80 days	—	1.07	5.11	3.0	10	—
II	—	Cottonseed meal + milo chop (1:6)	80 »	—	1.46	4.26	2.4	10	—
III	Groundnuts, 80 days	do.	80 »	1.335	1.44	3.18	0.1	1	9
IV	» 80 »	Milo chop (half ration)	80 »	1.530	1.53	—	0.9	5	5
V	» 80 »	Cottonseed meal + milo chop (1:6,½ ration) .	80 »	1.550	2.07	1.93	2.3	5	5
VI	» 40 »	Cottonseed meal + milo chop (1:6)	30 »	1.450	1.91	5.65	2.7	10	—
VII	» 40 »	do.	45 »	1.310	1.76	4.63	4.7	10	—
VIII	» 40 »	do.	60 »	1.748	1.64	4.24	4.9	10	—
IX	» 40 »	Milo chop	45 »	1.315	1.61	5.03	3.0	10	—
X	» 40 »	Meat meal, + milo chop (1:10)	45 »	1.327	1.74	4.66	1.8	10	—
XI	—	Cottonseed meal, rice bran (1:10)	80 »	—	85	5.83	9.0	(1) 5	(1) 4
XII	—	Cottonseed meal, rice bran, milo chop (1:4:4)	80 »	—	1.34	4.65	4.0	10	—

(1) One pig removed, sick.

In addition to the slaughter test, melting point determinations were made by the station chemist of samples of fat taken from the leaf fat, shoulder and along the back of three hogs of each lot (1). The hogs fed

(1) See *R.*, Oct-Dec., 1919, No. 1200. (*Ed.*)

on groundnuts throughout the period and killing soft, showed a much lower melting point than those receiving a straight grain ration throughout and also a lower melting point than those fed on grain for 30 to 60 days after grazing on peanuts for 40 days. In practically every case the melting point test corroborated the test in the coolers. The hogs were valued at the beginning of the test at 7.5 cents per pound. They sold for 10.9 cents on the Fort Worth market. the soft or oily hogs being docked 1.5 cents per pound. In spite of high prices for feed and labour a profit was made on every lot except No. 1.

37 – **Alfalfa Meal for Fattening Pigs, in Iowa, U. S. A.** — EVVARD, J. M., in *The Breeder's Gazette*, Vol. 75, No. 16, p. 918. Chicago, April 17, 1919.

At the Iowa Agricultural Station two groups of pigs weighing 52 pounds at the beginning of the experiment shortly after weaning time were fed on grain and tankage from a self feeder, free-choice style. Group I, on a ration of shelled maize alone, reached 225 pounds weight in 115 days. Group II, on a mixture of ground maize and ground alfalfa, took 138 days to make the same weight, i. e. 20 % longer time. This group consumed less tankage than the first one, but the figures for the cost of the feeds per unit of grain show that 18.8 pounds of alfalfa and 32.8 pounds of maize equal 10.3 pounds of tankage. Thus, even excluding 23 days of labour,. the group fed on ground alfalfa showed to least advantage.

On the other hand, ground alfalfa gives excellent results as an addition to maize for pregnant gilts, which have to keep in good condition without fattening.

38 – **Castration Due to Feeding Cocks Exclusively on a Meat Diet.** — PÉZARD, A., in *Comptes rendus de l'Academie des Sciences*, Vol. XLXIX, No. 24, pp. 1177-1179. Paris, Dec. 15, 1919. POULTRY

In a series of experiments carried out between 1901 and 1906, F. HOUSSAY (1) studied the modifications produced in cocks and hens by an all-meat diet. Amongst the results obtained, this author found a diminution of sex dimorphism ; — progressive sterility, cocks losing their fighting instinct, hens acquiring spurs, etc.

Having established that sex characters depend on the genital glands, the author was led to investigate whether the facts observed by HOUSSAY were not connected with some modification of these glands, resulting from the kind of feeding. The modifications of sex dimorphism appearing in cocks fed on meat can be interpreted rationally by the work carried out by the author between 1910 and 1918.

The following are the conclusions arrived at from these investigations : —

The variations in sex dimorphism appearing in meat-fed cocks can no longer be attributed to the *direct* influence of the diet. The truth is that an exclusively meaty diet brings about a slow intoxication of the organism, to which the genital glands are especially sensitive and in consequence

(1) F. HOUSSAY, Variations expérimentales. Études sur 6 générations de poules carnivores (*Arch. de Zool. exp. et gen.* VI, 1907, pp. 137-332). (*Author's note*)

of which they may gradually become atrophied or not develop. Then, as a *secondary* effect there appear the well-known modifications which result from castration.

These results may serve as basis for an explanation of the neutralisation of worker bees, or better for the inverse transformation of a worker larva to a virtually fertile queen. In addition, they show that the response made by the organism to the suppression of the testes is unified whatever be the cause of this suppression (physiological, pathological or by operation).

Results of the same nature were obtained by SCHEPELMANN on geese (1906) (1) and by C. B. PAUL on rats (1906) (2). They give a glimpse at the generalisation of the facts connected with castration due to feeding.

BEE-KEEPING

239 - **Bee-Keeping and Honey Production in the United States.** — JONES, S. A., in *U. S. Department of Agriculture, Bulletin*, No. 685, pp. 61. Washington, June 20, 1918.

Statement and discussion of numerous statistical data relating to bee-keeping and honey production in the United States. A series of Tables gives for each State: the number of hives on farms, the percentage of total swarming in the various months, wintering (food and protection against cold), losses from disease and during wintering (causes and percentages), annual production of honey per colony, the total annual honey production, the form of honey produced, the colour of the honey, the disposal of the honey taken (domestic use or for market), the value of the export of American honey from 1911 to 1917, the import of honey into the United States from 1911 to 1917, the principal plants furnishing nectar and pollen with average dates of the beginning and end of flowering periods, the plants furnishing nectar and pollen for surplus honey (as distinct from that which the bees consume). In conclusion the geographical distribution of the more important honies and the conditions and prospects for the 1918 honey season are given.

Dealing only with the general averages for all the States we have the following figures:

INCREASE IN THE NUMBER OF COLONIES IN THE VARIOUS MONTHS OF THE SWARMING SEASON IN PERCENTAGES OF THE TOTAL ANNUAL INCREASE: March 3.5 %, April 16.4 %, May 25.1 %, June 36.2 %, July 14.8 %, August 4 %.

WINTERING. — Usual length of period between autumn and spring nectar flows: 5.8 months; longest period that the bees remain in the hives without a flight in an ordinary winter: — 1.5 months; amount of honey stored per colony at the commencement of the winter: — about 33 lb.; method of wintering: — in cellars 9.1 %; in double walled and packed hives, 9 %; packed or in cellar (not separated), 4.3 %; packed above, 2.5; wrappings of tar paper, etc., 0.9 %; straw covering and

(1) SCHEPELMANN,, Ueber die gestaltende Wirkung verschiedener Ernährung auf die Organen. der Gans (*Arch. f. Entw.*, Vol. XXI, 1900; Vol. XXIII, 1907). — (2) C. B. PAUL, On the Influence Excessive of Meat on the Male Reproductive Organs (*Journ. of Phys.*, Vol. XXXIV, 1906). (*Author's note*).

iscellaneous, 1 %; total percentage of hives protected against cold, 5.8 %; (in the southern States this precaution is not necessary).

Losses from disease in summer and winter. — Summer sses: — in 1915, 1.5 % of the colonies; in 1916, 2.3 %; in 1917, 3.5 %; inter losses from all causes: — in the 4 winters of 1914-1915 to 1917 — 918, 12.6, 13.3, 10.1, and 18.7 respectively.

Annual honey production per colony. — Average for all States uring the quinquennial period 1913-1917, 41.6 lb.

Total production of honey in the United States (census of 1909): - 54 814 890 lb.

Form in which the honey is produced (percentages for the 4 years 914 to 1917, respectively). — Comb honey in sections: — 41.7, 40.0, 3.1, 37.9 %; honey extracted by centrifugal machines, draining or ressing: — 42.1, 41.0, 43.8, 48.4 %; comb honey more or less broken nd mixed with liquid honey ("bulk" or "chunk" honey): — 16.2, 9.0, 18.1, 13.7 %.

Colour of the honey. — White 42.8 %; light amber 29.5 %; mber 17.1 %; dark 10.6 %.

Exports and Imports. — For the fiscal years ending June 30, 1915, 916, 1917 and for the 6 months ending December 31, 1917 respectively here were the following values, in dollars, for *exports*: — 114 038, 52 487, 736 139, 1 254 887; and the following values, in dollars, for *mports*: — 255 274, 232 896, 455 167, 580 742.

Prior to the war the export was chiefly to Germany, during the war t was mainly to the United Kingdom. Imports came chiefly from in- ular possessions and from Central America. The quantities imported n the above-mentioned years and the average values were: — 303 965 21 224, 427 650, 227 092 gall. worth 41.1—44.1—67.7—112.7 cents per gall.

Plants furnishing nectar. — Percentage of the total honey ollected, furnished by the nectar of each kind of plant: Alfalfa, 7,7 % — lsike clover, 1.4, %; *Melilotus* 6.2 %; white and crimson clover, 19.6 %; ruit tree flowers, 0.6 %; lime 3.5; *Ilex opaca*, 1.1 %; *Robinia* sp., 0.9 %; *Diospyros virginica*, 0.5 %; *Oxydendrum* sp., 1.6 %; *Liriodendron* sp. .8 %; *Nyssa* spp., 3.1 %; other trees, 3.8 %; *Ilex glabra*, 1.6 %; *Rhus* .7 %; other shrubs, 7.4 %; *Rubus strigosus* and other species, 0.6 %; ther wild plants with small fruit, 0.6 %; buckwheat, 2.9 %; cotton, 4.0 %; other plants cultivated in large crops, 1.7 %; aster 1.4 %; *Soli- lago virgaurea*, 2.1 %; *Polygonum persicaria*, 2 %; *Bidens* sp. and *Co- reopsis* sp., 1.3 %; other miscellaneous plants, 7.6 % — Blends: — Alfalfa + sweet clover, 1.4 %; mixed clovers, 2.0 %; clover + lime, 4 %; other blends, 5.9 %.

240 – **A Possible Explanation of the Sex Question in Bees.** — See No. 238 in this *Review*.

241 – **The *Araujia*, Plants Dangerous to Bees.** — See No. 188. in this *Review*.

SERICULTURE

242 – **The Partial Sterilisation of Mulberry Leaves in Silk-worm Feeding.** — SACCHI, R., in *Le Stazioni sperimentali agrarie italiane*, Vol. 52, Nos. 7-9, pp. 332-348. Modena, 1919.

The partial sterilisation of mulberry leave has been held up as a preventive against " flacherie ,, and as a means of obtaining more silk of better quality.

In order to test the value of this opinion, the author made a series of experiments, of which the ones described in the present study form the last part.

From previous experiments (1) it was concluded that :—

1) If the worms are fed on leaves washed with water or an aqueous solution of lysoform or " tachiol " (silver fluoride), far fewer leaves are consumed than if they had not been subjected to the treatment described.

2) Although silk worms fed on moist leaves eat less they weigh more than those fed on dry leaves.

3) The treatments described did not prevent the occurrence of a few sporadic cases of " flacherie ,, and emaciation.

4) The silk cover of cocoons from silk worms fed on partially sterilised leaves is heavier than that from silk worms fed on ordinary leaves. This increase in weight also occurs when the silk worms are fed on leaves sufficiently well washed with fresh or boiled spring water.

5) The feeding of silk worms with washed leaves has a favourable influence on the quality of the silk, particularly on the length, tenacity, and elasticity, as well as the weight of the reeled silk.

The greater weight of silk and the lower consumption of leaves, previously observed in 1906 by Prof. P. BUCCI (*Bollettino della Società degli Agricoltori italiani*, No. 4, 1906), suggested that larvae fed on treated leaves would assimilate a greater quantity of nutritive principles from the leaf.

In order to check the accuracy of this idea, the author made a series of weighings and analyses of the leaves fed, of the leaf residues collected, and of the excreta collected. In this way the data grouped in the subjoined table, among others, were obtained.

The quantity of dry matter ingested and assimilated by the silk worms fed on washed or partly sterilised leaves is lower than in the case of untreated leaves. The surplus weight of larvae and cocoons is due to a higher content of water. When the cocoons are dried, those from silk worms fed on natural leaf weigh more than those from silk worms fed on washed or treated leaf.

These results agree with similar ones obtained by VERSON (*Annuario della R. Stazione bacologica di Padova*, Vol. XXXIV, 1917). The author concludes that washing or partial sterilisation of the leaves prevents neither " flacherie " nor jaundice ; it does not assist in the production of silk but on the contrary appreciably diminishes it, and it does not affect the qualities of the silk. Consequently in the present state of things, the practice is not to be recommended.

(1) See *R.*, July, 1917, No. 655. (*Ed.*).

	Control lot	Lot fed on leaves sterilised with lysoform solution	Lot fed on leaves sterilised with tachiol solution
eight of 6 silk worms at end of 4th stage .	1.750 gm.	2.430 gm.	1.957 gm.
» » 6 » » » » » 5th » .	23.590	26.397	29.640
aves fed during 4th stage	942	840	732
» » » 5th »	4270	3450	3510
af residues collected during 4th stage. .	212	202	194
» » » 5th » . .	975	954	954
xcreta collected during 4th stage. . . .	110	100	94
» » » 5th »	984	1165	1131
ilisation of dry matter in the leaves during the 5th stage : —			
Fats	35.445 %	23.074 %	28.731 %
Total nitrogen.	13.243	9.156	12.102
Cellulose	23.746	9.040	16.540
Ash	11.012	2.677	5.746
eight of 30 cocoons	76.070 g	60.950 g	69.065 g
rcentage of cover on cocoons.	15.910 %	15.290 %	15.250 %

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

3 – **The Application of Electricity to Farm Work in Sweden.** — BJERKNES, K., in *Tidskrift for det Norske Landbruk*, Year XXVI, No 10, pp. 409-425 + 28 figs. Christiania, Oct., 1919.

ELECTRICAL PLANT FOR AGRICULTURE. — The greater part of the ectrical energy is produced in Sweden by hydro-electric stations, of which ie three following supply considerable quantities of energy for agricul-ıral purposes : — Kungl. Vattenfaldstyrelsens (anlaeg), near Irolhättan ıd Älfkarleby ; the plant of the Electricity Company of Hemsjö, near arlshamn, and that of the South Sweden Electrical Society near Lagan,) the north of Malmö.

The main lines of the Vattenfaldstyrelse have an average tension of) 000 volts, which is reduced to 20 000 volts in the great transformers t the 2nd grade stations, and then to 1500-3000 volts in the 3rd grade tations. This current goes to the agricultural exploitations and serves irectly to drive the large motors, threshing machines, etc., while for light-ıg and for driving smaller motors the voltage is further reduced by uitable transformers to 220 volts and even less.

Each 3rd-grade station serves the country round about within a ra-ius of 3-4 kilometres, where the subscribers form a Distributing Society hich, construets local lines with its own capital.

To facilitate such undertakings the State grants long term loans on ood conditions from a special fund, called the Statens Kraftlaanefond.

The Distributing Societies unite to form District Societies or Cen-ral Societies, with their own engineers who carry out controls and im-rovements and are present in consultation, etc. These societies buy

material in common and wholesale, thus effecting considerable economy on cost prices and obtaining better results as to quality and type of material.

For the cost of electric current, the Vattenfaldstyrelse works a double scale of prices : 25 *ore* (0.345 fr. *at par*), per kilowatt-hour for lighting purposes, and 10 *ore* (0.139 fr. at par) for agricultural purposes. (In addition there is a supplement for the payment of interest and upkeep).

The Electricity Company of Hemsjö works in a similar manner ; only in this case, it is the Company itself which carries out the construction of the local lines, and it exacts in return a higher supplement from the users.

Use of Electric Power on Farmas. — As well as for lighting purposes, electric power serves to drive the following machinery : threshing mills, straw presses, winnowing machines, straw and fodder choppers, kibblers, presses, elevators, cheese-making machines, milking machines, etc.

Material and Instruments. — A series of notes accompanied by photographs serve to give an idea of the many and varied application of electricity to farm work. There is a detailed description of current transformed to 1500 volts, illustrated with plans, schemes and figures. There are also be mentioned : Small motors carried on hand barrows, a centrifugal pump installation, a very simple and practical elevator for bags, a fodder unloading and storing plant, and the " Comor " electric milking machine, the use of which ensures a remarkable saving of work and at the same time the most absolute cleaness and purity of the milk. These machines are attached to all the cows at the same time and the milking is done simultaneously and rapidly.

244 – **Tractor versus Horse Team.** — *The Pastoral Review*, Vol. XXIX, No. 10, p. 94. Melbourne, October 16, 1919.

The first agricultural tractor trial in New Zealand was held at Dar field, in Canterbury, in 1919.

Six tractors competed in a ploughing test, and four completed the plots, and it was the average work of the latter that was adopted as basis for comparison of costs, etc. The ground operated upon was lea land with a sparse covering of grass. The cost of a tractor was set down at £500, days worked per year 100, and the life of a tractor 500 days. The cost per acre at 5.37 acres per day was estimated at 14 *s.* 5 *d.* The cost for a year of a six-horse team, and an extra horse, was £630 6s., the number of days worked per year 250, and an estimate of 5 acres ploughed equalled a cost of 10 *s.* 1 *d.* per acre, a difference of 4 *s.* 4 *d.* in favour of the horse team over a tractor. Therefore the tractor can successfully supply tractive power for farm implements, but it cannot economically displace horses for constant work, on account of its higher cost of operation under present conditions.

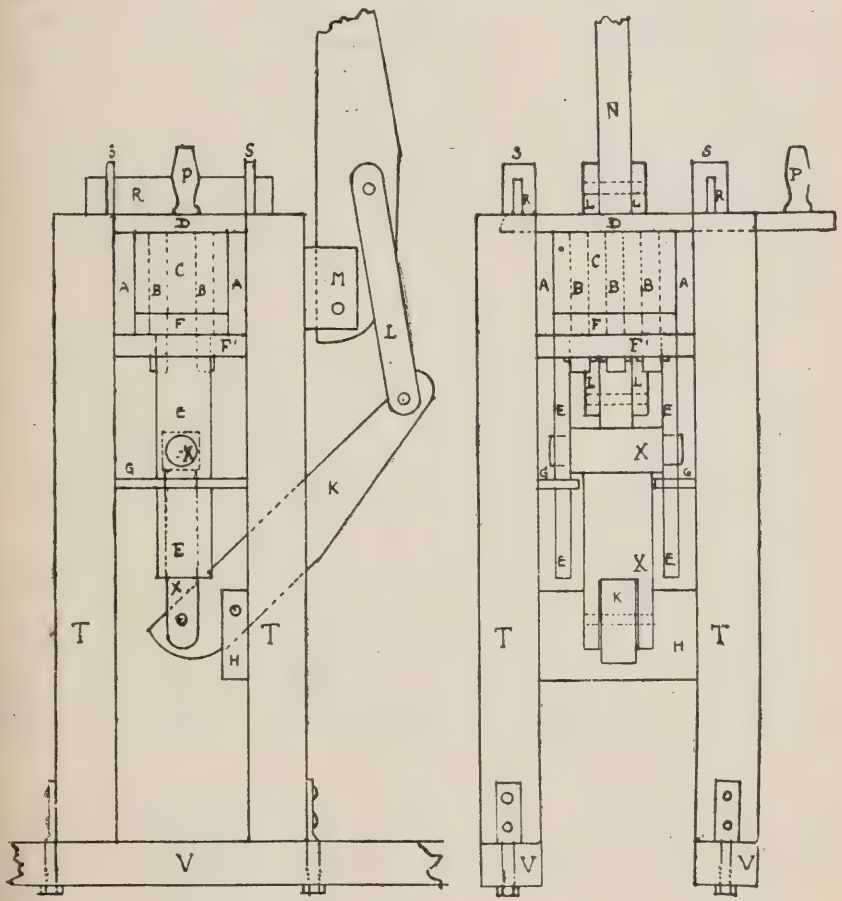
245 – **A Press for Fuel.** — Déjardin, L., in *Journal d'Agriculture pratique*, New Ser., Vol. XXXII, No. 45, pp. 410-911. Paris, Dec. 2, 1919.

This press is intended to utilise, in the form of perforated briquettes, coal and coke dust (1) and also all farm products that are thrown aw

(1) See *R.*, Dec., 1918, No. 1416. (*Ed.*)

or are not considered usable as fuel, such as sawdust, dead leaves, paper, wheat and oat husk, etc.

For the purpose it is sufficient to mix the material to be pressed very thoroughly with a binding substance and to press the mixture. As, how-



Fuel press. — Vertical sections.

ever, it would not be appropriate to incur expense in order to utilise rubbish, the choice falls on very "fat,, clay soil an excellent binder which costs nothing and gives very good results when used in the proportion of 10 % to 12 % for coal or coke dust, and 15 % to 20 % for woody material, sawdust, dust from working machinery, husk, leaves, etc. When using paper, it is soaked some days in water, and the size glutinous content acts as a binder.

The following is a brief description of the press in question : —

A chamber *C*, supported on 4 posts *T*, and made to receive the mixture for pressing, is traversed by vertical rods *B*, fastened on to a fixed plate *F'* which are employed for perforating the briquettes. A mobile plate *F'* pierced with holes to let through the rods can be pushed from below upwards by the levers *K* and *N*, through two uprights *E*, guided by grooves *G*, and a connecting rod *X*. A cover *D* closes the top of the chamber *C* and is held solid by clamps *R* which are held in slots *S* bored in iron plates.

The method of working is simple : The mobile plate *F'* is lowered to the bottom of the chamber by raising the lever *N*. The cover *D* is drawn off by the handle *P*. The chamber is filled, the cover replaced and the lever *N* is forced down. Then the cover *D* is removed and, to free the briquette from the rods which have made the holes in it, the lever *N* is lowered to the ground. It remains only to lift off the briquette, by sliding it carefully, and setting to dry.

Pressure is exerted by means of two levers *K* and *N*, connected by 2 connecting rods *L*. The lever *K* acts directly on the rod *X*. The lever *N* acts on the lever *K*. If the arms of the lever *K* are in the ratio 1 : 4 and those of the lever *N* in the ratio 1 : 7, the rod *X* receives a force equal to $4 \times 7 = 28$ times the force exerted at the end of the lever *N*. If a man weighing 75 kg. hangs on to the end of the lever *N*, the matter enclosed in the chamber will undergo a pressure of $75 \times 28 = 2100$ k a pressure which may be increased by lengthening the lever *N*.

The measurements of the briquettes are 0.22 metre × 0.18 metre × 0.07 metre. When dry, they have a mean weight of 3.5 kg. if made of coal dust.

This press is easily made with hard rough sawn wood and bolts. There is no fitting and little iron work. Thus the farm staff which looks after the cart repairs could make it. Moreover, any hands which have not been discharged at the beginning of winter can be set to making briquettes when not otherwise employed.

246 – **Review of Patents.** — *Authorities :* GERMANY, *Landwirtschaftliche Maschinen und Geräte, Arterner Zeilschrift, Artern* (*Province of Saxe*). FOR BRITISH INDIA, CANADA, FRANCE, NEW ZEALAND, SWITZERLAND, UNITED KINGDOM, UNITED STATES, see *R.*, January 1920, No. 110.

TILLAGE MACHINES AND IMPLEMENTS. — *Germany :* 313040 Multi-furrow mechanically drawn plough with arrangement for ploughing on a curve, keeping an even width of furrow ; 313066 Motor plough with driving wheel adjustable on the axle ; 313136 Motor plough with engine self stoping in presence of obstacles ; 313139 Beam (multi-furrow plough) oscillating at too great resistance in soil ; 313179 Motor plough with 2 front wheels, one of which runs in furrow.

Canada : 193735 Harrows ; 193784 Rake tine.

United States : 1314678 Arrangement for attaching harrows to plough ; 1314838 Motor cultivator ; 1316359 Small motor plough with stilts ; 1318230

Cutter pulveriser ; 1318979 Lister plough ; 1320507 Cultivator accessory ; 1320851 Combined plough and harrow ; 1321004 Cultivator.

New Zealand : 42054 Mobile support for farm implement.

United Kingdom : 132810 Motor two-furrow balance plough ; 133671 Cultivator.

Switzerland : 83806 Rotary tiller ; 83808 Motor plough.

Drainage and Irrigation. — *Germany :* 313157 Ditching machine with screw excavator and transporter.

Manures and Manure Distributors. — *United States :* 1314766 Manure sowing machine ; 1320782 Dung spreader.

United Kingdom : 133104 Manufacturing process for calcium cyanamide (using as catalytic agents carbon tetrachloride and an alkaline compound capable of fixing chlorine).

Drills and Seeding Machines. — *Germany :* 313002 Sowing process.

Canada : 193786-193847 Seeding machines.

United States : 1314683 Potato planting machine ; 1314863 Seeding machine ; 1316288 Maize sower.

New Zealand : 42025 Sower.

United Kingdom : 133520 Potato planter.

Cultural Prerations. — *Canada :* 193783 Couch grass eradicator ; 193789-193809 Weed eradicators.

United States : 1316183 Orchard cultivator ; 1316316 Cotton chopper combined with cultivator.

Reapers, Mowers and Other Harvesting Machines. — *Canada :* 193572 Reaper for Kaffir corn heads.

United States : 1318296 Hay tedder ; 1320406 Reaper and binder.

Machines for Lifting Root Crops. — *United Kingdom :* 133157 Potato lifter and sorter.

Threshing and Winnowing Machines. — *United States :* 1317181 Screening machine ; 1317736 Maize huller ; 1320968 Huller.

Machines and Implements for the Transport, Preparation and Storage of Crops. — *Germany :* 313308 Root slicer.

Canada : 193882 Sheaf loader.

United States : 1314694 Cart with arrangement for loading and lifting shocks ; 1314815 Shock loader ; 1316081 Feeder for silo fodder chopper ; 1317882 Hay lifter ; 1318110 Fodder press ; 1318789 Hay-cock maker.

Switzerland : 83809 Straw-press feeder.

Traction of Agricultural Machinery. — *Germany :* 313283 Three-wheel tractor for ploughs and other cultivating implements, attached laterally to the back driving wheel.

Feeding and Housing Livestock. — *Canada :* 193788 Manger ; 193814 Water trough.

United States : 1318159 Pig oiler.

Apiculture. — *New Zealand :* 41374 Syrup container for bees.

Industries depending on Plant Products. — *Canada :* 193466 193542 Flax beating machines.

DAIRYING. — *Canada :* 193858-193859 Milking machines.
United States : 1316072 Milking machine.
New Zealand : 41313 Milk measuring apparatus ; 41978 Milking machine teat-cup.
United Kingdom : 132900 Cheese press.

RURAL ECONOMICS

247 – **Some Points Brought Out by Successive Surveys of the Same Farms (1912-1917) in Different Parts of the United States.** — HAWTHORNE, H. W. (Office of Farm Management), in *Journal of Farm Economics*, Vol. I, No. 1, pp. 24-37. Lancaster, Pa., June, 1919.

The Office of Farm Management of the United States Department of Agriculture, in addition to the annual statistical surveys conducted on a large number of agricultural areas in various parts of the United States, undertook several surveys in 7 different areas, with the object of studying from, the dynamic point of view the organisation and economical results of the areas under survey. The areas chosen were : —

1) The hill section of Ohio.
2) The dairy section of Wisconsin.
3) The corn belt in Indiana.
4) A trucking district of New Jersey.
5) An apple-growing section of the Shenandoah Valley in Virginia.
6) A trucking section of Florida.
7) A citrus fruit section in Florida.

The surveys in the first three areas have extended over a period of 5 years, those in the last four areas 2 or 3 years. The discussions in this paper centre around the first 3 areas, for each of which there are records for 5 years or longer. To facilitate the interpretation of the surveys a brief description of the areas follows : —

1) THE OHIO AREA. — This area in the hill country of Ohio is representative of much of the hill land drained by the Ohio river. The topography grades from rolling to very steep and is often rocky ; large unbroken fields being seldom found. The land is fairly productive and valued at $31 per acre The farms are from 4 to 9 miles from railroad points and the wagon roads are hilly and unimproved. The farms average around 160 acres, 22 % of which is unimproved (woodland and wasteland). Half the land is used for pasture and ¼ in growing crops, of which about one-fourth is in maize, one-fourth in wheat and small grains and one half in hay. Only 6 % of the maize raised was sold, also 35 % of the wheat and 16 % of the hay. Of the farm receipts, 15 % was from crops sales, 6 % from dairy products, 21 % from cattle, 14 % from sheep, 12 % from hogs and 17 % from poultry. Usable records include 25 farms for 7 successive years, but the data for the last year have not yet been tabulated.

2) THE WISCONSIN AREA. — This is an area typical of a considerable part of Wisconsin dairy region, The surface is rolling to hilly, the land is valued at $ 100 per acre, and only the main wagon roads are im-

proved. The farms average 148 acres, of which 11 % is unimproved; little more than one-third of the land is in pasture and a little more than one-half in crops. The crop land is divided almost equally among maize, the small grains and hay. Practically all of the crops grown in this area are fed on the farms, and the crop sales are but 3 % of the farm receipts, half of which come from the sale of dairy products or, in general $^2/_3$ from dairying and cattle sales, excluding hog sales, which represent over $^1/_4$ of the receipts. The records include 60 farms for 5 consecutive years.

3) The Indiana Area. — The area in Indiana is representative of much of the eastern part of the corn belt area. The surface is level to rolling. Much of the land is tile-drained, and it is valued at $ 185 per acre. The wagon roads are improved — most of them gravelled — and railroad points are readily accessible the whole year round. The farms average 127 acres and only 5 % of the land is unimproved. About $^1/_4$ of the land isin pasture and $^3/_4$ in crops. Nearly one-half of the crop land is in maize, one-third in' small grains (mainly oats) and the remainder in hay. A larger proportion of the crops produced in this area was sold from the farms than in either of the other areas. About 24 % of the maize, 80 % of the oats and 26 % of the hay was sold. Thirty five per cent of the farm receipts arose was from the sales of crops, 40 % from hogs and 13 % from cattle. In this area the records are from 100 farms for 5 successive years.

Two-fold object of the discussion. — The surveys further concern the variations in the economic results of the farms studied which took place during the pre-war period and the war period (1916-1917). The years 1912-1915 (inclusive) are taken for the pre-war period because the rapid rise in the prices of farm products in the United States caused by the war did not begin to be felt in agriculture until 1916. Hence in this presentation the war period includes the 1916 and 1917 crops. These data are all that is available as yet for tracing the effect of the war on American agriculture. Hence they are given with some detail.

Variations in labour income over the period 1912-1917. — The labour income variation from year to year in each of these areas is of fudamental interest (Table I).

Table I. — *Labour income variations for* 24 *farms in Ohio,* 60 *in Wisconsin and* 100 *in Indiana, from* 1912 *to* 1917 *inclusive.*

	1912	1913	1914	1915	1916	1917	Average of years before the war	Average of years during the war
Ohio	$ 512	$ 110	$ 190	$ 160	$ 324	$ 635	$ 153	$ 480
Wisconsin	—	214	56	68	626	1 075	113	850
Indiana	—	220	15	225	791	794	153	792

In the Ohio area the labour incomes for the years prior to the war ranged from $ 110 to $ 190. The year 1913 might be considered below normal for the following reasons: — It was the poorest wheat year, the yield

per acre being scarcely more than one half of the averages of 1912, 1914 and 1915, the quantity sold being less than one-half of the year of next lowest production and less than one-fifth of that of the year of highest production. The price was slightly lower than in 1912, 18 % lower than in 1914 and 16 % lower than in 1915. The apple crop was nearer a failure than any other year, the quantity sold being 17 % of that of the next poorest year and only 3 % of that of the best year. The price was from 5 to 30 % lower than in other years. The price of wool was 20 % lower than any other year.

Very low labour incomes are shown for the Wisconsin area in 1914 and 1915, which reflect the prices of dairy products and hogs for those years. In 1914, the prices received for dairy products were lower than any other year. They were slightly higher in 1915 but almost entirely overcome by the lower price of hogs.

The low labour income in the Indiana area in 1914 reflects the low maize yield, which was 10 bushels less per acre than in 1913 and 4 bushels less than in 1915, Hogs were lower in 1915 than any other year, but the crop sales were $ 278 more per farm than in 1914, oat sales were 30 % more than in 1914 and wheat sales almost double.

All the areas show higher labour incomes in 1916 than in the earlier years, and the Ohio and Wisconsin areas still higher in 1917, owing to combinations of higher price levels and increased production. In Indiana the labour income in 1917 scarcely exceeded that of 1916 due to a severe hail storm which swept diagonally across the area studied. If only the records of farms outside the strip affected were considered, the income for 70 would have shown as much increase over 1916 as in the other areas. The difference in actual value of the labour incomes for the years before the war and during the war is less than indicated, because the dollar had less purchasing value during the war than before.

VARIATIONS IN PERCENTAGE RETURN ON INVESTMENT OVER A PERIOD OF YEARS. — The percentage return on the investment after deducting the farmer's labour from the farm income is shown in Table II.

TABLE II. — *Percentage return on investment on* 25 *farms in Ohio,* 60 *in Wisconsin and* 100 *in Indiana from* 1912 *to* 1917 *inclusive.*

	1912	1913	1914	1915	1916	1917	Average of years before the war	Average of years during the war
Ohio	2.8 %	2.2 %	3.4 %	3.0 %	5.4 %	7.8 %	2.8 %	6.6 %
Wisconsin	—	3.9	2.9	2.9	5.8	7.7	3.2	6.8
Indiana	—	4.6	3.8	4.6	6.7	6.5	4.3	6.6

PERCENTAGE INCREASE IN RECEIPTS AND EXPENSES DURING THE WAR. — These are collected in Table III in the form of averages for the two-year period 1916-1917 and for these 2 years separately, for each area and for the 3 areas as a whole, and represent the percentages of increase in the averages for the period before the war, which includes the years 1912-1915.

TABLE III. — *Receipts and expenses on 25 farms in Ohio, 60 in Wisconsin and 100 in Indiana, during the war as percentages of those before the war.*

	Receipts			Expenses		
	Average of 1916 and 1917	1916	1917	Average of 1916 and 1917	1916	1917
Ohio	152 %	127 %	177 %	124 %	111 %	137 %
Wisconsin	155	136	174	129	116	143
Indiana	141	132	150	129	107	151
Average of 3 areas	**149**	**132**	**167**	**127**	**111**	**144**

Table III shows clearly that whereas the receipts rose by 49 % as compared with the pre-war period, the increase in expenses, on the average for the 3 areas, was only 27 %. The details of this phenomenon are given in the Table for the 2 years during the war and for the 3 areas separately. It may be deduced that if for 1916 the increase in expenses was only $^1/_3$ as great as the increase in receipts (average of the 3 areas), in 1917 it rose to $^2/_3$, and it may be judged that the tabulation of the 1918 data will show the increase in expenses to be equal to or in excess of the increase in receipts.

HOW FARMERS " SPEEDED-UP " DURING THE WAR. — In setting forth the data in Table IV an attempt has been made to show some of the ways in which the farmers in the areas studied contributed, with little if any additional labour available, to raise production in order to meet the food crisis brought about by the war.

TABLE IV. — *Intensity of production during the war on 25 farms in Ohio, 60 in Wisconsin and 100 in Indiana, as percentages compared with the pre-war period.*

	Before the war	During the war	% increase
The Ohio area.			
Months of labour	17.3	17.6	2
Acres in crops	42	46	9
Number of animal units	14.5	16.7	15
The Wisconsin area.			
Months of labour	22.2	23.0	4
Acres in crops	81	81	0
Number of animal units	16.1	18.2	13
The Indiana area.			
Months of labour	19.4	19.4	0
Acres in crops	40	46	15
Number of animal units	56	59	5

In the Ohio area, with an increase of only 2 % in the amount of labour, the crop area was increased 9 % and the amount of live stock 15 %. In the Wisconsin area with an increase of 4 % in the amount of labour, the crop acreage was maintained and the number of cows was increased by 13%. In the Indiana area with no increase in the amount of labour the maize acreage was increased 15 % and the number of hogs sold increased 5 %. It is readily seen that the farmers in each area, as a whole, increased the volume of their business. There were all sorts of variations on individual farms ; some show much greater increase than is indicated and some less.

The response came along the line of the prevailing type which is the best for the locality or the farmers. In the Ohio area where most of the crops are marketed through live stock, about one-half of the livestock increase was in cattle, which is the major enterprise of the area. In the Wisconsin area, a dairy section, the increase was in the number of cows. In Indiana, an area in the corn belt, where most of the maize is fed to hogs, there was no increase in the crop acreage, but the cropping became more intensive by decreasing the acreage in small grains and in hay, and increasing the maize acreage.

ANNUAL OUTPUT PER MAN. — During the five-year period in the Ohio area, the quantities of the several farm products that these farmers put on the market annually per man has been worked out. These data are of special interest also, because this area is generally regarded as of much less importance agriculturally than either of the other areas ; yet this region includes a considerable proportion of the rural population and of the farm land in the United States, and in addition to what it produces for home consumption it makes a very appreciable contribution to the food and clothing supply of the nation. These data are summarised in Table V.

TABLE V. — *Annual output per man on 25 farms over a period of five years, 1912-1916, in Washington Country, Ohio.*

Stems	Quantities
Grain	2 822 pounds
Roughage	6 042 »
Potatoes	3 bushels
Apples	15 barrels
Eggs	486 dozen
Wool	247 pounds
Butter	124 »
Cattle (live weight)	1 850 »
Hogs (*id.*)	1 089 »
Sheep (*id.*)	600 »
Poultry (*id.*)	196 »
Equivalent of cattle, hogs, sheep and poultry in dressed meat	2 293 »

VARIATIONS IN LABOUR INCOMES OF INDIVIDUAL FARMERS. — Having shown the averages of farmers' labour incomes in the different areas, it is

very opportune to show also the annual variations on each farm, so as to bring out how far individual circumstances, closely connected with the farmer himself, affect the economic results of the work each year. In a final Table, 8 farmers in the Ohio area are placed for 6 successive years in the order which each occupied for labour income. On examining this Table, it is seen that the first 3 farmers showed great uniformity in standing for the 6 years in question. For each of these 3 farmers, the placing in rank is very close. On the other hand, for the rest of the farmers, there were greater variations of which it is important to investigate the causes. Thus farmer No. 4 descended from 1st rank which he occupied in 1914 to 8th in 1912 : farmer No. 5 who occupied 1st rank in 1915 fell to 18th in 1917 ; farmer No. 6 from 3rd rank in 1912 and 1914 to 18th in 1917 ; farmer No. 7 rose from 17th rank in 1914 to 1st in 1916, and farmer No. 8 who was only 5th in 1912, passed to 8th in 1913.

In, 1912 farmer No. 4, on account of sickness in the family, had to reduce his crop acreage by 12 %. In 1914 he was first in relative standing, having increased his poultry flock and gained on colts he bought and afterwards sold. In 1915, he was sixth in relative standing and his income was reduced by the loss of a cow and a horse. In 1916, he was fifth, and his wheat index was lower than in any other year. In 1912. farmer No. 5 was 8th and he ranked lower among his neighbours in wheat yield per acre than he usually did. In 1913, he was higher in wheat yield per acre than ordinarily, and his hogs fed out exceptionally well. In 1914, he dropped lowest in hay yield per acre. In 1916, he went below his ordinary standing in yield per acre of maize. In 1917 he showed greatest variation, through contracting steers for winter feeding on a cent-a-pound advance, while his neighbours who fed steers sold at an advance of 2 to 3 cents per pound over purchase price.

Number 6 dropped very low in 1916. He had a high priced team of work horses which went blind and he stood lower in rank in yield per acre of wheat than any other year.

Number 7, an excellent wheat grower, dropped to 13th in 1914 with his yield per acre of that crop, and he also ranked much lower in yield per acre of maize than ordinarily. In the latter years, however, he ranked better, through the higher price of wheat and wool he obtained on account of the time when he sold.

In 1913, No. 8 improved his position compared with 1912, by renting additional land and so having a larger crop acreage, and in succeeding years he showed a certain uniformity in results.

These illustrations are sufficient for establishing that there must be considerable variation in the incomes of individual farmers, even although the incomes of entire groups from year to year may be fairly constant. The other 17 farmers in the Ohio group show a similar amount of variation, and the Wisconsin and Indiana areas tell the same story.

SELECTING THE BEST FARMS IN AN AREA FROM A SINGLE YEAR'S STUDY. — In the earlier years of farm management it was held to be difficult to select the best farms in an area by observations on the general surroundings.

The following survey work confirms this, and the study of farms for a successive years shows that even after a single year's study there is considerable chance for error in selecting the best farmers, as determined by those with highest average labour incomes over periods of 5 or 6 years. Thus, taking 10 farms out of 100 with highest labour incomes, only 45 % of them will be amongst the 10 with highest average labour incomes over a five or six year period. On the other hand, selecting the 50 best farms, for any one year, there are 76 chances out of 100 that these 50 farms will be among the ones found best. Hence the importance of using wide groupings of farms when data for only one year are available.

INCREASING SIZE OF BUSINESS. — These surveys have emphasised the principle that an increase in the size of a farm does not always give an increase in the farmer's labour income, and that the ability and personal qualities of the farmer are the principal factor. Thus the first consideration for an 80-acre farmer in the corn belt who is making a lower labour income than his neighbours on farms of equal size, is to make good on his 80, rather than to get more land.

SINGLE YEARS' STUDIES VERSUS CONTINUED STUDIES. — The advantages of several-year studies do not in any way lessen those of single year surveys. In a study of the broad economic principles affecting an agricultural area or type of farming, the single year surveys probably have the greater value in that a larger number of farms can be studied than is practicable in continued work. There are, however, a number of well-recognised types of farming carried on in different sections of the country, such as the fruit-farming area of Virginia, the trucking districts of Florida, the citrus fruit districts, the dry-farming districts of the west, where it is nearly impossible to obtain results for one year that will give a true idea of conditions prevailing over a period of years ; only work carried on over a number of successive years gives such results. The continued work also has an added advantage over the one-year study of giving reliable information regarding the trend of agricultural development.

248 - **Economy in Stock Feeding.** — MARENGHI, E., in *Atti della R. Accademia dei Gergofili*, Year CLXVI, Nos. 2-3, pp. 86-97. Florence, August 25, 1919.

1) The use of fodders — economically speaking — should be based on obtaining from them *the greatest transformation value*.

2) Among the various means employed to attain this end, concerning the physico-mechanical preparation of the foods, the use of special condiments and the method of rationing the stock, the latter is of the greatest economic importance.

3) Rationing cannot be determined — case by case — according to absolute rules, on account of the many unknown quantities occurring in feeding phenomena in general.

The *ration factors* (dry matter minimum quantity of protein matter per unit of weight, nutritive ratio, etc.) are only *indices* of very uncertain practical value as compared with the multiplex circumstances under which they must be used.

It appears certain, however, that the most important *factor* in this uestion is the *nutritive value*, that is, the proportion of digestible protein to ernary substances (fats and non-nitrogenous extract reduced to the same hysiological value). The feeding value R is expressed analytically by the llowing formula:—

$$R = \frac{a}{2.44\, g + e}$$

here a, g and e indicate the percentage content of the fodder in digestile *albuminoids*, *fats* and *nitrogen-free extract* respectively. The quanty of fats is multiplied by the coefficient 2.44 to reduce it to the same approximate physiological value as the nitrogen-free extracts, granting that ne feeding power of each is in the same proportion (which is about 2.44) s the respective heats of combustion.

If the food in the ration is not in the most suitable proportion for the ind of animal, the age and the work done (rest, work, fattening, milk prouction, etc.), the substances which are ingested in excess — in comparison ith the others — are only partly utilised, according to this hypothesis as o their utilisation, in terms of the law of definite proportions. Mixtures are or the essential purpose of preventing these losses or reducing them to he minimum.

The author observes in this connection that food mixtures, to conform o the economic point of view, should surpass the transformation value f their components ; that is, we should have: —

$(M_1 v_2 + M_2 v_2)$ $(M_1 + M_2) v_3$, where M_1 and M_2 denote the quanties of fodder, and v_1, v_2, and v_3 the respective transformation values of M_1, of M_2, and of the mixture $(M_1 + M_2)$.

The solution of the problem of mixtures (from the analytical point of iew) is very simple. It evidently requires that the *desired relation* be included among the *relations* of the foods to be mixed. The problem may e reduced to the following form :—

$$x = \frac{Ri_1 - a_1}{a_2 - Ri_2}$$

where R denotes the food value which the mixture is to have, a and a_2 dehote the quantities of digestible albuminoids contained in the foods M_1 nd M_2 respectively ; i_1 and i_2 the sum of the fats and nitrogen-free xtracts reduced to the same physiological value, also contained in M_1 nd M_2.

4) With feeding stuffs there arises the economic problem of control nd valuation, as with fertilisers, the difference being that, under the ame of *digestible albuminoids*, there is a series of many heterogenous nirogenous substances which are not of the same physiological value. There re also *fats* and *nitrogen-free extracts*. Moreover, the market does not rovide *types of simple foods*, namely foods with a basis either of carbohydrates or of fats or of albuminoids, which permit of determining the unit alue of each of the useful principles that have to be bought on the market

for the purpose of correcting the farm fodders which have an excessively wide food value.

This difficulty may be surmounted by admitting that there exists a certain *fixed relation* between the values of the substances indicated and that these are reducible to *units of the same value*, called *commercial units* by the use of a formula of the type :—

$$N = c + K_1 g + K_2 a.$$

where N = commercial units ; c, g, and a = content of the food in carbohydrates, fats and albuminoids respectively ; K_1 and K_2 = *unit value* of the fats and of the albuminoids respectively with regard to that of the carbohydrates considered equal to unity.

The relation between the values of the food principles has been previously determined according to physical and other considerations, and later on by means of a mathematical process, suggested by EMMERLING, based on the application of the Method of Least Squares.

The estimation of fats along with that of nitrogen-free extract, is carried out, in the first case, on the basis of the respective physiological value or in other words of the respective calorific values. The mean ratio which exists between the heat calories is 2.44 : 1, or, by rounding the figures slightly, 2.5 : 1. For albuminoids, the proportion between them and the nitrogen-free extract being, in the commonest normal rations, on the average 1 : 5 or 1 : 6, this ratio is simply considered valid, also for the respective commercial values.

The method followed by EMMERLING is the following : A certain number (fairly large) of foods is taken, their composition and market price being known. Now, supposing x, y and z are used to denote the unit value of the nitrogen-free extracts, the fats and the albuminoids, and granting that the market price (p) of each of the foods depends on the content of these principles (c, g, a), the following equations will be obtained :

$$\begin{aligned} c_1 x + g_1 y + a_1 z &= p_1 \\ c_2 x + g_2 y + a_2 z &= p_2 \\ \cdots\cdots\cdots\cdots & \\ c_n x + g_n y + a_n z &= p_n. \end{aligned}$$

On solving the system of equations (more than determined) by the Method of Least Squares, the *most probable values* of x, y and z are obtained, and consequently the relation between them also is found, which in the present instance is wanted. In the author's opinion this method cannot be rigorously applied because, if the foods in question have some affinity — as, statistically speaking, should be the case in order that the Method of Least Squares may be applicable — an indeterminate system of equations is arrived at, which is therefore insoluble from the fact that the relation between the homologous coefficients of the unknown quantities is, within certain limits, constant. For foods having the characteristic of affinity, such as the *cake*, *hay*, *straw* and *food grain* classes, the application of the

ethod of Least Squares leads only to a system of equations of this form, hich is insoluble because indeterminate : —

$$x + [b + \varepsilon_1'\ ]\,y + [c + \varepsilon_2'\ ]\,z = [p + \varepsilon_3'\ ]$$
$$x + [b + \varepsilon_1''\ ]\,y + [c + \varepsilon_2''\ ]\,z = [p + \varepsilon_3''\ ]$$
$$x + [b + \varepsilon_1'''\ ]\,y + [c + \varepsilon_2'''\ ]\,z = [p + \varepsilon_3'''\ ]$$

here ε_1', ε_2', ε_3', ε_1'', ε_2'', ε_3'', ε_1''', ε_2''', ε'''... are relatively small uantities.

The author quotes as an example the data for the *cake* class : —

Kinds of cake	Digestible matter			Ratio between content of albminoids, fats and nitrogen-free extract
	Albumin-oids	Fats	nitrogen-free extract	
	%	%	%	
nseed cake	24.64	8.94	32.27	1 : 0.36 : 1.31
olza "	25.23	7.54	23.74	1 : 0.30 : 0.90
oundnut	23.29	7.15	18.35	1 : 0.30 : 0.78
ndecorticated cotton	17.95	5.24	19.03	1 : 0.29 : 1.06
ape.	25.23	7.54	23.74	1 : 0.26 : 0.93
c. etc.	...	...	...	.....

If, on the other hand, the foods themselves do not fulfil the condition affinity, the system is no longer indeterminate, it is true, but the values the unknown quantities derived from it are liable to very high probable rors, and on that account are not to be accepted as accurate.

The problem may, in the author's opinion, be solved by fixing the proortion on arbitrary criteria, because the results obtained — in practice — ary little, with the variation of the proportion itself (within the ordinary mits of variation. subordinate to the fact that albuminoids are of greater alue than fats, and fats, in turn, than nitrogen-free extract).

The author, by way of example, supposes that linseed cake has been urchased at 40 francs per quintal and that on a check analysis this cake not up to standard, as shown by the figures below :

Useful principles	Composition		
	Guaranteed	Found	Difference
	%	%	%
lbuminoids	22.10	18.00	−4.10
ats	9.40	8.60	−0.80
itrogen-free extract	30.50	30.00	−0.50

The variations in the *compensation* to which the buyer is entitled, by pplying the 5 different proportions adopted in the subjoined table, oscilte between 5.03 and 5.65 francs per quintal. Such a difference suggests hat, in commercial evaluations of feeding stuffs for stock, there is reason

to prefer the proportion 1 : 2 : 3 only because it is simpler to use and not for other causes.

Proportion adopted for the calculation	Commercial units			Price of commercial unit	Compensation
	Guaranteed	Found	Difference or units less		
	U	U'	$(U-U'=d)$	$(40 : U = p)$	$(d\ p)$
1 : 2 : 3	115.60	101.20	— 14.40	0.35	5.04
1 : 2 : 4	137.70	119.20	— 13.50	0.29	5.36
1 : 3 : 4	147.10	127.80	— 19.30	0.27	5,21
1 : 2 : 5	159.80	137.20	— 22 60	0.25	3.15
1 : 3 : 5	169.2	145.80	— 23.40	0.24	5.60

5) Another fundamental economic problem lies in the choice of the foods offered on the market.

The most suitable depends not only on the relative cost price but also on the transformation value at the farm.

By indicating as general terms : —

m_1, m_2	m a series of foods,
p_1, p_2	p_n their market price,
v_1, v_2	v the transformation value
c_1, c_2	c_n the relative suitableness

we shall have : —

$$c_1 = v_1 - p_1\ ;\quad c_2 = v_2 - p_2\ ; \ldots\quad c_n = v_n - p_n\ ;$$

and of all these foods, the one to be considered most suitable is that for which c is greatest.

The problems of economic suitability cannot be solved, in a general way, by basing the judgment of worth on the relative cost per commercial unit.

On the other hand, there are no sure data on the physiological value of foods with respect to the greatly varying conditions of consumption.

KELLNER attempted to treat the question by means of a long series of researches, especially on the feeding of cattle, but he succeeded in unravelling only part of the tangled skein.

He was able, indeed, to fix the conception of *valency* and express the physiological value of foods in *starch equivalents*, defining the latter as a quantity of fodder which gives the same yield in fat (250 gm.) as a kilogramme of starch, provided that, the fodder itself be consumed under certain conditions. Hence the idea of *valency* is an idea to which only a relative signification must be attributed.

KELLNER'S researches, however, have served to show how the same quantity of digestible feeding principles (according to the old analytical tables) can give rise to very different yields in terms of the nature of the foods, which he divides into two groups : *a*) those of *full value* : *b*) those of *least value*.

Feeding stuffs of *full value* are characterised by a *feeding power*, so to speak, proportional to their content in digestible *carbohydrates*, *fats* and *albuminoids*, such as oilcakes, meals, etc.; in short, all food substances entirely or almost lacking in fibre.

Fodders of *least value* have, on the other hand, a feeding power which never comes up to the theoretical power, that is, corresponding to the respective content in useful principles, and it is all the lower, the higher the fibre content is. In this group are straw, hay, etc.

The determination of *starch equivalents* of various foods is done in a very simple way by using KELLNER'S experimental data.

The fundamental *valencies* serving as basis for the calculation are the following: —

Useful principles	Starch equivalents
Albuminoids	0.94
Fats of common fodders (hay: straw, etc.)	1.91
Fats of non oily seeds	2.12
Fats of oilseeds	2.41
Carbohydrates	1.00

For fodders of *full value*, the calculation consists in multiplying the content of *albuminoids*, *fats*, etc., by the respective valency and in adding up the products obtained.

In the case of fodders of *least value* the same method is followed except for reducing the number of starch equivalents so found in terms of a particular *coefficient* which is proportional to the fibre content as established by the following figures:

Fibre content	Coefficient of reduction
Under 4 %	0.29
4-6 %	0.34
6-8 %	0.38
8-10 %	0.43
10-12 %	0.48
12-14	0.53
Over 14 %	0.58

KELLNER'S researches have enabled the data on the physiological value of foods to be expressed a little more precisely, but have not solved the problem from the economic point of view. It could not have been otherwise, given the method of the experiments, in which the value itself of the foods is determined by taking as the basis a certain ration, an *immutable* basis, considered as normal.

The yield obtained under these conditions cannot correspond to the effective curve of the phenomenon which, for evident reasons, conforms to the law of diminishing returns.

6) Hence the economic problem of livestock feeding still bristles with many difficulties which will be overcome, little by little, only by multiplying the researches so as to be able to trace, among other things, the *yield curves* of foods under the most usual conditions.

The actual elements to hand at present are confined to regulating — within certain limits, commercial transactions, but they do not help to solve the very important economic problems of the *choice* and *substitutes* of foods. Trying to use them for such a purpose may lead to very grave errors ; but farmers are generally by nature so shrewd and prudent that they very seldom allow themselves to be influenced by false doctrinal conceptions.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

249 – **The Use of Artificial Cold to Accelerate the Maturing of Wines.** — MATHIEU, LOUIS (Director of the Oenological Station of Burgundy), in *Le Froid*, Year VII, Vol. VII, No. 6, pp. 133-135. Paris, June 1919.

In France the great inroads made in the stocks of old wines by consumption at the front during the war, and, the requirements of the whole world in fine wines are entailing the consumption of the recent vintages. Hence the necessity of accelerating the maturation of these wines without depending entirely on time for the requisite mellowness.

In order to obtain such rapid ageing without resorting to the use of processes requiring industrial plant, the author recommends the use of artificial cold, as refrigerating machinery provides at all seasons the action of cold, which brings about the clarification of the wine.

The freezing point of wine, which is between — 6° and — 8° C, may be reached without fear. In case of freezing, which is always partial, the wine must be allowed to liquefy again completely before racking, otherwise the wine from the frozen part would be much weaker than the first lot drawn off, and would have the qualities of watered wine (the separation of the ice can also be used to give concentration), but the wine would have to be racked before warming up again, or part of the substances made insoluble would redissolve.

To the physical action of the cold may also be added the influence of oxygenation at a low temperature. simply by aeration effected by injecting air with a pump. This aeration should be done after replacing the compressing plunger of the pump by a rounded tube of red copper bored with small holes on a horizontal diameter. Small sharp blows are given to the wine pump when empty, so as to send through, not a current of air, but small bubbles at the bottom of the cask. A large volume of air would remove alcohol and bouquet. What has to be got is a momentary saturation with oxygen of the mass of the wine. A few touches of the pump lasting 10-15 seconds are sufficient once or twice daily, as the oxygen in the interval is fixed by the oxidisable elements. According to the amount of oxidation the wine will stand and the agents causing it, these repeated operations accentuate the colour, bouquet and flavour more or less quickly as regards the quality of old wines, and experiments have shown that the

fineness thus obtained is much greater than at a high temperature, which justifies the reputation of frozen Burgundies.

If the wine had not finished fermenting and still contained active yeast, the effects of aeration on ageing would be very slight and might even be counteracted by a renewal of fermentation. Thus it is advisable with such wines to complete the fermentation, first re-activating the yeast by keeping in a warm place.

After racking on the spot the wines exposed to cold, as stated above, it may be beneficial in the case of wines destined to be bottled soon, to clarify them in the cellar in order to give them the right limpidity.

It will be clear that wines having a tendency to deteriorate (casser) must not be exposed to cold and especially aeration, because this would be the means of accelerating the consequences of their high degree of oxidisability.

It is interesting for makers to know the variations caused in the volume of wine by freezing, as these may give rise either to accidents or to losses of wine which might be attributed wrongly to other causes. The action of cold on wine causes a regular contraction in volume down to + 5° C,. then concentration quickly becomes very slight or even almost inappreciable down to the point of solidification. As soon as freezing begins a notable increase in volume is to be observed, which is all the greater as the volume of water solidified becomes more considerable and as the freezing proceeds.

There is another cause to which the increase in volume may be attributed viz., the presence of dissolved carbon dioxide in the wine, for example in the case of new wines before being drawn off their lees or still in process of fermentation. At the moment of freezing the dissolved gas is liberated in the form of bubbles, some of which are shut into the crystals of ice, and are all the greater the quicker solidification takes place. In one experiment the author obtained an apparent increase in volume of 14 % in a white wine still on the lees and slightly frothy at the time of sampling.

The necessary precautions should be taken to avoid loss by leakage through open bung-holes and cracks or through stoppers, especially with sparkling wines.

250 – **The Part Played by Iron in the "Casse Bleue" of Wines.** — PIÉDALLU, A., in *Comptes rendus de l'Academie des Sciences*, Vol. CLXIX, No. 23, pp. 1108-1109. Paris Dec. 8 1919.

The author had occasion to examine some wines that had been carried in tanks of unprotected sheet iron which is liable to be attacked by wines. as these are always acid. All the wines showed the same signs of "blue discolouration" (casse bleue), in this case a real synthetic alteration. Clear at first, they grew turbid on exposure to the air and deposited their colouring matter on the sides and bottom of the bottles, and at the same time the surface became covered with an iridescent film. This shows, as already observed by LAGATU, that blue discolouration can take place perfectly well without the help of diastases (without denying the existence of the latter elsewhere).

The author's observations prove : that all wines travelling, thus deteriorate ; that wines so affected get rid of their iron by oxidation (e. g., by

the addition of oxygenated water) ; that in order to preserve their marketable qualities, it is sufficient to place them in presence of a reducing agent, by simply drawing them off into casks well smoked with brimstone ; and that it is always better to avoid putting wines in contact with iron.

251 – **Manufacture and Chemical Composition of Concord Grape Juice.** — HARTMANN, B. G. and TOLMAN, L. M., in *U. S. Department of Agriculture, Bulletin* No. 656, pp. 26, 1 fig., Washington, May 8, 1918.

Much work has been done on the chemical composition of American grapes, but the available information is restricted principally to the acid and sugar content and is chiefly interesting to viticulturists. Hence the research reported in the Bulletin here summarised on the subject of the manufacture of the juice of the " Concord " grape (a variety of *Vitis Labrusca*) and the chemical composition of this commercial product.

The authors give advice regarding the handling and keeping of the grapes and describe in detail the different stages of the process of manufacture which includes : — Crushing and stemming ; heating the crushed fruit ; pressing ; sterilising and bottling the juice for storing ; siphoning the juice ; Bottling and pasteurising for sale.

A series of Tables shows the chemical compsition of the juice as prepared and after 4 months storage ; during this period 100 cc. of juice lose on the average 0.53 gm.of solids ; 0.02 gm. of sugar as invert before inversion ; 0.10 gm.of sugar as invert after inversion ; 0.51 gm. of non-sugar solids ; 0.13 gm.of total acid as tartaric ; 0.24 gm. of total tartaric acid free and combined ; 0.24 gm. of cream of tartar ; 0.12 gm of ash; 13.0 cc. of alkalinity soluble ash, N/10 acid ; 0.04 gm. of tannin and colouring matter. There is then a substantial decrease in solids during storage ; about half is due to the precipitation of cream of tartar and alkaline tartrates and the other half to the precipitation of pectin bodies and gums. There is a definite decrease in non-sugar solids, total acids and total tartaric acid ; on the other hand the sugar content is not materially altered.

Another series of tables gives detailed analyses of 104 examples of commercial juice from 6 different factories. They indicate that a well manufactured " Concord " grape juice contains less than 0.4 % of alcohol (it exceeds this percentage only when the pressing took too long) ; it contains no sucrose ; the polarisation of the inverted solution at 87.7° C is laevorotatory ; it contains about 0.5 gm. of free malic acid per 100 cc. ; it contains free tartaric acid and from 0.36 gm. to 0.79 gm. average 0.54 gm. of cream of tartar per 100 cc.

252 – **The Maple Sugar Industry in the Province of Quebec, Canada** (1). — VAILLANCOURT C., in *The Agricultural Gazette of Canada*, Vol. 6, No. 11 pp. 959-960. Ottawa, Nov. 1 1919.

The maple sugar industry has increased threefold during the last three years in the Province of Quebec. This is certainly due in part to increased

(1) The following articles have been published on the sugar maple in this *Review:* — January 1915, No. 46, GALLOIS, M., *Notes on the sugar maple.* ; February, 1915, No. 194, SOMERVILLE, W., *North American Sylviculture* ; April, 1916, No. 390, SHEDD, O. M., *Variations in the*

price of beet and cane sugars, but also largely to the sugar-making schools established by the Department of Agriculture in different parts of the province, and to the demonstrations given by special instructors in production centres. The three schools are at La Minerve (Labelle county), Beauceville (Beauce county) and St. Louise (L'Islet county). Modern methods of sugar and syrup making are taught in these schools. The courses last 10 to 15 days, and the Department pays the board of the students while they are in attendance at the sugar school.

A summary of the work done at these schools in 1919 is given below.

At La Minerve, 371 gallons of syrup were manufactured; the number of maples tapped was 3500 during the sugar season (March 24 to April 27).

At Beauceville, 14 230 gallons of sap were collected from 3500 maples and 3565 pounds of sugar manufactured (March 19 to April 24). There were 328 visitors and 27 pupils.

At St. Louise, 26 194 gallons of sap were collected from 5000 maples tapped (March 25 to April 27), and 210 pounds of sugar were made, 537 gallons of syrup and 100 pounds of "taffy" (tire). This school was visited by 458 persons ; 28 pupils took the course.

Five instructors gave 94 demonstrations in 18 counties throughout the province, with model apparatus for preparing sugar and syrup during the demonstration. The results of these demonstrations have been most effective, and it is said that about 75 % of the sugar manufactured in 1919 was of first quality.

In 1919, the total crop of sugar was less than in 1918. It would probably amount to 30 million pounds of sugar which, if valued at only 25 cents a pound, makes a total of 7 500 000 dollars. The crop of 1911 was only about 10 million pounds of maple sugar, which shows the great progress made by the industry during the last 10 years.

253 - **An Analytical Study of Spanish Olive Oil.** — FERNANDEZ, O. and BUSTAMANTE, F., in *Revista de la Real Academia de Ciencias exactas y fisicas y naturales de Madrid*, Vol. XVII, No. 7-9, pp. 281-286. Madrid, 1919.

The 33 samples of pure olive oil analysed by the authors at the "Instituto Nacional de Higiene de Alfonso XIII" were of the 1917 and 1918 crops, mostly from the province of Seville. The results obtained are summed up in the following table, which also gives, for purposes of comparison, the constants for Californian and Italian olive oil :—

mineral composition of the leaf and stem sap in American wild vines and sugar maple. ; September 1916, LEWIS T. G., *The forest species of Canada.* ; September 1917, No. 792, SAVOIE, F. V., *The Maple Sugar and Syrup Industry Schools of Quebec Province in Canada.*

Comparative table of the constants of olive oil from California, Italy, and Spain.

		Specific gravity	Refractive index	Iodine index	Saponification index	Acidity %	Specific temperature of reaction
Californian oil	maximum	0.9180	1.4718	89.3	194	8.21	109.7°
	minimum	0.9162	1.4703	78.5	78.3	0.20	94°
	average	0.9170	1.4713	85.3	85.3	1.20	101°
Italian oil	maximum	0.9180	1.4713	86.1	86.1	2.79	104°
	minimum	0.9103	1.4705	79.2	79.2	0.57	95°
	average	0.9155	1.4709	81.6	81.6	1.11	99°
Spanish oil	maximum	0.9180	1.4664	89.5	89.5	3.20	97.9°
	minimum	0.9128	1.4629	76.3	76.3	0.173	94°
	average	0.9154	1.4661	83.9	83.9	1.34	95.9°

254 - **The Lumbang-oil Industry in the Philippines.** — AQUILAR, R. H., in *The Philippine Journal of Science*, Vol. XIV, No. 3, pp. 275-285, Manila, March, 1919.

The manufacture of lumbang oil in the Philippine Islands has been so far in the hands of Chinese, who have made no attempt to improve the the methods of production and the oil which they express is dark in colour and of a disagreable odour.

But the oil industry generally in the Philippine Islands is undergoing a radical change, the manufacturers having a strong desire to increase the production and improve the quality of the product. Some of them, hitherto exclusively engaged in the manufacture of coconut oil, are now turning their attention to other oils, among which lumbang oil holds an important place. The object of the present paper is to discuss some of the more important points with a view to the best possible production of the oil.

There are two kinds of lumbang nuts worked in the Philippines for oil: — *Aleurites moluccana*, known as " Lumbang bato " (1), and *A. trisperma* (2) known as " Lumbang banucalag ". The former is more widely distributed and more abundant than the latter and is of greater industrial importance " Lumbang banucalat " is indeed almost unknown in the Manila market, and when the word " lumbang " is used alone it generally means " Lumbang bato ". The Chinese, who are the chief dealers in Lumbang oil are unwilling lo handle the " banucalag " variety because it is supposed that the nuts of that variety cause, on contact, skin eruptions ; but the author is of opinion that there is no foundation for that belief.

It would be interesting to develop the oil of " lumbang banucalag " as a separate industry, but meanwhile no doubt considerable profit would

(1) This is the " Bancoulier " or " Moluccan Walnut " Regarding *Aleurites* and their oils and the different " wood oils ", see *R.*, Apr., 1912, No. 662 ; *R.*, Dec. 1913, No. 1339. *R.*, Oct., 1914, No. 899 ; *R.*, May, 1917, No. 436 ; *R.*, July-Sept. 1919, *N.* 997 and *R.*, Oct.-Dec., 1919, No. 1237 (*Ed.*) — (2) Or *A. tritoba.* (*Ed.*)

be obtained by using the nuts of this species as well as those of *A. moluccana*. The increased production of these oils is important in view of the fact that a similar oil to Lumbang banucalag oil, Chinese wood oil, is highly appreciated in the United States by paint manufacturers. The fruits of both species of *Aleurites* mature and drop from the trees in June and July and the best time for gathering them is July-August. According to information obtained from the Chinese merchants the gathering of lumbang nuts could be much extended in Mindanao, more especially in the Davao Gulf district, where these nuts are known by the name "biao" and where large quantities are not collected. Hitherto there has been hesitation in placing capital in the lumbang oil industry because it was feared that insufficient nuts could be obtained to supply it regularly. But now, although the number of lumbang trees in the Philippines is not definitely known, it is certain that the production of nuts is abundant and quite sufficient to assure a profitable business to the oil industry.

The author deals with *Aleurites moluccana* and *A. trisperma*, their nuts and the oils obtained from them. He draws the following conclusion: — The lumbang oil industry, if properly developed, will be a profitable business.

It is much less desirable to purchase the kernels than the nuts from which to obtain the kernels, because oil from the kernels bought in the market is almost always of inferior quality to that obtained from freshly extracted kernels. No change took place in the oil content of whole uncracked nuts of lumbang bato stored for more than a year; but the content and quality of oil in Lumbang banucalag nuts are considerably reduced when they are stored for a similar time: the shell is insufficient to protect the oil in the kernel from oxidisation by the air and the kernels deteriorate very rapidly.

After expression, both kinds of oil can be kept satisfactorily in proper containers. It is therefore best, in the industrial season during which lumbang oil is expressed, to commence by using the nuts of *A. trisperma* and to store the nuts of *A. moluccana* to be dealt with when the former have been finished.

55 – **The Effect of Alkali Treatment on Cocoa.** — BLOOMBERG, E., in *U. S. Department of Agriculture, Bulletin* No. 666, pp. 20. Washington, May 9, 1918.

In the process of the manufacture of cocoa, the cocoa beans are roasted, the shells removed, the nibs crushed and the resultant product pressed so as to remove part of the cocoa butter. The pressed cake, ground and sifted, forms the cocoa of commerce. The removal of a part of the fat makes the colour of the cocoa much lighter. The manufacturers have tried, by various processes, to darken the colour of the cocoa so that it would more closely resemble chocolate. The commonest methods include the addition of alkalis or alkaline carbonates, ammonium carbonate or carbonate of magnesium. They are called "Dutch processes" from their place of origin. Under "alkali treatment" the author includes all such processes.

The investigations recorded in the present bulletin were under-

taken primarily with a view to ascertaining whether the alkali treatment rendered the cocoa more soluble, and what changes it caused. With this purpose in view the author made analyses of alkali treated and untreated cocoas and he determined the total ash, water-soluble and water-insoluble ash, and their alkalinity, and protein.

The results of the analyses show that the principal effect of the alkali treatment appears to be the increase in the colour of the aqueous solution. Treatment by alkali causes a decrease in the ash-free soluble matter and a slight increase in the amount of water-soluble protein ; this is, however, more then compensated for by a decrease in the solubility of non-nitrogenous substances which are normally soluble in water. A portion of the water-soluble protein of the cocoa treated with alkali appears to differ from the water-soluble protein in the untreated cocoa, since it is rendered insoluble when the water solution is made acid with 1% sulphuric acid. This difference between alkali treated and untreated cocoa may serve for detecting the alkali treatment.

Conclusions. — An alkali treated cocoa may be recognised:— By the high colour of the water solution ; by the presence of a water-soluble protein precipitable in 1 % sulphuric acid ; by the increase in the ash and alkalinity ratios. The assertion that alkali treatment increases the amount of cocoa soluble in water is absolutely without foundation.

256 – **Industrial uses for Cacao Shells.** — See No. 217 in this *Review*.

257 – **A Study of Fibre from *Agave Cantala* from the Industrial Point of View.** — See No. 203 in this *Review*.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

258 – **Meat from Madagascar** (1). — *Ministère des Colonies, Bulletin de l'Agence Générale des Colonies* (formerly *Bulletin de l'Office Colonial*), Year XII, No. 142, pp. 601-602. Paris, Oct., 1919.

The cattle in Madagascar are generally estimated at 8000 head. local consumption amounts to 270 000 head at most ; during the 4 years 1914-1917 the five factories then working, delivered to the food departments 16 737 tons of frozen meat and 10 364 tons of preserved meat, representing a total of 215 224 out of the cattle existing on farms in the colony. This came to only 43 044 head per year, which figure, added to that of the local consumption, gives 313 000 animals, a quantity much below that which the Madagascan herds can yield annually.

Four of the factories are situated near the sea : -- Boanamary (Majunga), Tamatave, Antongombata, and Montagne d'Ambre, to the south of Diego Suarez Bay ; one is situated at Tananarive itself ; a sixth, which began work in 1918 at Antsirabé in the Vahinankaratra on the plateaux, makes exclusively preserved pork. Diego and Tananarive make only preserved products, and Majunga makes preserved and frozen meat.

The production, which in 1914 came to 440 tons of frozen meat and 815 tons of preserved meat, had risen to 16 737 tons of frozen and 10 364 tons of preserved meat by 1917.

(1) See *R.,*jan., 1919, p. 1, and March, 1919, No, 274. (*Ed*).

These factories are supplied only from the herds in the north and centre. The south of the island, although very well off in cattle, has not yet any outlets for its production, and it appears certain that one or more factories could thrive there.

259 – **Experiments in Preserving Eggs in Italy.** — PASSERINI, M., in *Bollettino della Società italiana per lo studio dell'alimentazione*, Vol. I, No. 1-3, pp. 23-30. Florence, 1919.

AGRICULTURAL PRODUCTS; PRESERVING, PACKING, TRANSPORT, TRADE

From the results of a series of experiments conducted in 1918 at the Scandicci Agronomic Institute (Florence), the author concludes that : —

1) Eggs may be preserved dry for over 7 months, provided they have been taken very fresh, carefully washed, have had their shells lightly rubbed with fat (lard) containing 1 % of salicylic acid, and have been kept in a cool dry place. The loss in weight, due mostly to the evaporation of moisture through the shell, amounted to only 5 % in 231 days.

2) By wrapping each egg thus greased in oiled paper, the loss in weight may be reduced to less than 3 % in 231 days. In both these cases the eggs keep their taste and smell almost unaltered and the albumen remains liquid in the same way as eggs preserved in lime water.

3) Immersion in lime water gave excellent results ; with perfectly fresh eggs, carefully washed, and sufficiently pure lime, like that from statuary marble, this method is good for keeping eggs, in a cool place, for 14 months. The slight taste of lye which eggs preserved in ordinary lime water take on in the course of time probably depends, not on the penetration of small quantities of lime into the interior of the egg, but on impurities in the lime, especially alkaline hydrates, as this taste is not found in eggs preserved in sufficiently pure lime water. Some writers think that the liquefaction of the albumen is due to the passage of small quantities of calcium hydrate into the interior of the egg, but the author's experiments show that, even with dry preserving, this occurs. Hence it probably depends on a molecular change in the albumen in time and perhaps also on the beginning of hydrolysis of the albumen concerned.

Partial sterilisation at 60° C., before immersion in lime water did not give good results.

5) Dry-preserving of eggs previously heated to 60° C and., placed in closed vessels gave disastrous results, whether these eggs were or were not coated with fat or gelatin. The same result followed when the eggs were exposed to ether vapour. Probably better results would have been obtained by placing the eggs in containers sterilised by heat, but in order to keep the contents from further taint, difficulties would have been encountered which were too unsurmountable in practice.

260 – **The Prevention of Breakage of Eggs when Shipped in Car Lots.** — PENNINGTON, E., MACLEER, H. A., GREENLEE A. D., assisted by DAILEY, F. X. and ALBIN, H. C., in *U. S. Department of Agriculture Bulletin* No. 664, 31 pp. 8 Pl. 12 Figs. Washington, April, 25 1918.

These investigations were carried out during two seasons on the car lots of eggs sent from different parts of Texas and Minnesota in the eastern States over an average haul of 1200 miles, in order to determine the causes of damage to the eggs during transport.

When the following conditions were realised: — 1) eggs sent in car loads packed in good, well-made, standard cases with new fillers and flats, with properly placed and suitable cushions at top and bottom; 2) cases tightly stowed and efficiently braced; 3) cars handled in accordance with good railroad practice, especially when switching; the total damage referable to transit was less than 2 %.

The size of the egg influences its safety in transit. Eggs which were longer than the cells of the fillers showed 3.71 % damages. The eggs with lightly cracked or dented shells, but with membrane unbroken showed a transit damage of 2.88 % as compared with 1.77 % for eggs with sound shells. Applied to case lots of broken eggs, the increased liability to damage is noteworthy.

Egg cases must be standard, symmetrically made with 5 or preferably 6 cement coated nails at each corner of the sides and bottom and at the centre partition. While cottonwood, gum, and tupelo cases vary but little in strength, but the cottonwood has, on the whole, the greatest number of advantages.

Medium fillers or heavier ones should be used. It is absolutely necessary that the filler be perfectly new. Suitable cushions of excelsior, with a flat, should be placed on the top and bottom of the case. The quarter filler is strong enough and it forms an even cushion. Corrugated board on the top of the case affords practically the same protection as the excelsior cushion, provided it takes up the slack.

More damage occurs in the top layer of eggs than in the deeper layers of the case, and more in the ends than toward the centre.

When cars are buffed with straw at the bunkers there is a slight but clear rise in damage as the cases near the centre of the car. There is also a progressively increasing breakage in the rows as they progress from the middle line to the side of the car.

The location of layers is apparently immaterial. The load of eggs must be a solid unit in the car, fitting without play. This is the most important factor in avoiding damage in transit.

The amount of damage in properly loaded cars buffed with straw is slightly less than in the same cars buffed with wood. When the straw buffing is placed at the bunkers and extends from the top of the load to the floor of the car, at least 50 % of the refrigeration is lost. Braces nailed to the car seldom arrive in place. They cause much damage. Self-bracing of the load by means of suitable strips placed below the cases is most satisfactory. Cars having steel underframes show a slightly greater amount of damage than those with wooden underframes.

The shocks incident to ordinary freight train handling while running, seldom cause damage in well-stowed cars. The shocks incident to switching are sometimes destructive. More care should be exercised in switching cars containing eggs. While the haul in wagons or trucks between the railroad terminus and the warehouse or store may be responsible for some damaged eggs, the breakage is ordinarily not more than 1 cracked egg per case.

PLANT DISEASES

GENERAL INFORMATION

LEGISLATIVE AND ADMINISTRATIVE MEASURES FOR PLANT PROTECTION

261 – **The Control of *Trogocarpus ballesterrii* a Hymenopteron Injurious to the Pistachio Tree, in Sicily, Italy** (1). — *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Acireale, Bollettino* 37, pp. 9-10. Acireale, 1919.

In view of the Decree dated September 28 1919 by which *Trogocarpus ballestrerii* (syn. *Megastigmus ballestrerii*), commonly known in the country as the Pistachio Worm, is entered amongst the parasites whose compulsory destruction may be ordered (2), and considering the damage caused by this chalcid fly to the yield of the pistachio (*Pistachia vera*) and the economic importance of this plant in districts where the crop is most extensively cultivated, the Minister of Agriculture issued the following Decree, dated October, 7 1919.

Art. 1. — Combative measures against *T. ballestrerii* are made compulsory in the communes of Caccamo, Ventimiglia, Petralia Sottana and Gangi, in the Province of Palermo; Vita, in the Province of Trapani; Alessandria della Rocca, Burgio, Canicatti, Casteltermini, Caltabellotta, Cattolica Eraclea, Favara, Licata, Lucca Sicula, Montevago, Raffadali, Ravanusa, S. Angelo Muscaro, S. Biagio Platani, S. Giovanni Gemini, S. Stefano Quisquina, Sciacca and Camarata, in the Province of Girgenti; Butera, Mazzarino, Pietraperzia and Riesi, in the Province of Caltanisetta; Bronte, in the Province of Catania, and Rosolini in the Province of Syracuse.

Art. 2. — In the above mentioned communes, proprietors or exploiting parties of pistachio plantations are obliged to destroy in spring all the female flowers of turpentine trees (*Pistachia Terebinthus*) in their plantations or near-by, within a radius of one kilometre.

Art. 3. — Proprietors of turpentine plants situated near pistachio plantations must allow the destruction of the female flowers of this plant by proprietors or exploiting parties of pistachio plantations, without the right to any indemnity or compensation.

Art. 4. — The burning of pistachio fruits attacked by the insect in question is compulsory, both in the case of fruits which fall before harvesting and those which are included in the harvest.

Art. 5. — Those failing to conform to this Order, will be liable to a fine of 200 lire per hectare of pistachio plantation owned or worked by them, ex-

(1) See *R.*, July, 1918, No. 831. (*Ed.*)

(2) See *R.*, Oct.-Dec., 1919, No. 1260. (*Ed.*)

cept for the provisions of Art. 22 of the law of June 26, 1913, No. 888, which defines the steps to be taken in order to foresee and combat plant diseases, approved by the Decree of the Lieutenant Governor of the Kingdom on March, 12 1916, No. 723 (1).

Art. 6. — The Prefects of the provinces concerned are charged with enforcing the present decree, through the district observatories of phytopathology, the mayors and the royal carabineers.

The present decree will be published in the leaflet of legal notices for the provinces concerned and on the notice boards of the communial town halls indicated in Art. 1.

DISEASES NOT DUE TO PARASITES OR UNKNOWN ORIGIN.

262 – **Investigations on the "Mosaic" Disease of the Potato in the United States.** — SCHULTZ, E. S., FOLSOM, D. HILDEBRANDT F. M. and HAWKINS L. A., in *Journal of Agricultural Research*, vol. XVII, No. 6, p. 247-274, 8 pl. Washington, D. C. Sept. 15, 1919.

The poato "mosaic" although more common and, apparently, particularly destructive in certain sections of the United States, is nevertheless widely distributed in the rest of North America.

The disease has a decidedly detrimental effect on the yield. The characteristic symptoms of the disease are noticeable on the aerial parts of the plant, especially on the foliage. These symptoms may be modified or obscured by differences in environment or variety. Tubers of diseased plants trasmit the disease. Grafting a healthy scion upon a diseased stock, or of a diseased scion upon a healthy stock, may result in the development of the disease in the healthy part.

"Mosaic" may be transmitted by transferring juice from a diseased plant to a healthy plant. The disease can also be transmitted by the agency of aphids.

"Mosaic" apparently tends to increase the sugar content of the leaves and to reduce their starch content. "Hill selection" has not proved successful for maintaning healthy stock when practiced in fields in which there was a considerable number of plants attacked by "mosaic". On the other hand, pulling up the infected plants before the aphids became numerous was an effective method for checking the spread of the disease.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

263 – **Investigations on the "Crown Rust" of Oats (*Puccinia coronata*), in Iowa, United States.** — MELHUS, I. E. and DURRELL, L. W., in *Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Botany and Plant Pathology Section, Research Bulletin* No. 49, pp. 115-144, 6 fig. Ames, Iowa, 1919.

In certain years *Puccinia coronata* Corda, restricts the production of oats in Iowa in a marked manner. It is noticed that this rust show

(1) See: INT. INST. OF AGRIC. *Annuaire international de législation agricole*, 6th year (1916), pp. 880-881. Rome, 1917. (*Ed.*)

itself epidemic one year while in the following year the disease is reduced to very small limits. Up to the present time the various factors which influence the growth, development and epidemiology of this rust had not been definitely studied.

From research carried out by the authors during 3 years it has been proved, firstly, that the minimum temperature for the germination of the uredospores of *P. coronata* is 1° C., the optimum temperature 17-22° C. and the maximum temperature 35° C. The optimum temperature for growth of the germ tube is 20° C. The germination of the uredospores produced in the greenhouse is variable. In some experiments less than 5 % of them germinated ; in others a germination percentage of 90 % was obtained. The average of the percentages for all the experiments at the optimum temperature was 21.9 %.

It is essential for the uredospores of *P. coronata* to be in direct contact with water in order to germinate. A saturated atmosphere does not furnish sufficient moisture for germination. Uredospores floating on a film of water germinate better than those immersed in water and for this reason heavier infection may be obtained when the uredospores are blown on to moistened plants than when they are applied in suspension in water.

Ordinary tap water used in the experiments carried out by the authors was found to be noticeably toxic to the germination of the uredospores. Vaseline and paraffin oil in contact with water act as stimulants to the germination of uredospores. Vaseline increased the percentage of germination by 23 % over the controls, while paraffin increased it by 70 %, under the conditions of the experiment. The environment in which the uredospores of *P. coronata* are produced, influences their germination to a certain degree. Uredospores borne on heavily infested seedlings do not germinate so well as those borne on plants approaching maturity. A still, humid atmosphere favours rapid maturation of the uredospores. Uredospores detached from the host plant and kept in a dry capsule at a temperature of from 13° to 20° C. showed increased germination after 6 or 7 days. The biologic form of " crown rust " which lives on oats, has as alternative hosts, *Rhamnus cathartiens* and *R. lanceolata*' which is one of the most widely distributed native species. *R. frangula, R. caroliniana* and *R. alnifolia,* according to the data collected, do not serve as hosts in the intermediate stage (aecidium) of the biologic form of " crown rust " which is found on oats.

R. lanceolata grows generally in the southern half of Iowa and in many localities the bushes are within a short distance of the oat fields.

R. cathartica is commonly used as an ornamental shrub on lawns and in public gardens. It bears annually the aecidium of crown rust and may well constitute one of the means of annually renewing infection.

There are in Iowa two native species of *Rhamnus* (*R. lanceolata* and *R. alnifolia*) and two introduced species (*R. cathartica* and *R. frangula*).

In the United States there are at least 10 native species of *Rhamnus*. However, it is only in a few cases that their relationship to crown rust of oats has yet been established.

264 - **Observations on the Perithecial Form of the "Oak Oidium" in Italy** (1). — PEGLION, V., in *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, Vol. XXVIII, Nos. 5-8, pp. 197-198. Rome, 1919.

On October, 1919, the author observed the presence of numerous very small perithecia on the leaves of a pedunculate oak grown from seed, on which, as is usual, a strong growth of oidium was evident. The perithecia were scattered over the mycelial spots existing on the two faces of the blade, but especially on the upper one.

Investigations carried out immediately, near Bologna led to the discovery of a very great number of these fructifications on pedunculate and hairy oak leaves gathered in different localities.

According to the author, the ascophorous form observed by him seems to correspond to *Microsphaera quercina* (Schw.) Burr.

DISEASES OF VARIOUS CROPS

265 - **The Ascomycete *Excascus purpurescens* and the Deuteromycete *Septoria rhoina* causing "Leprosy" (or "Reddening") and "Smallpox" respectively of Sumac (*Rhus Coriaria*): Diseases New to Italy.** — 1) TRAVERSO, G. B., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, No. 5-6, pp. 213-226, 2 pl.: 2) LO PRIORE, G. and SCALIA, G., *ibid.*, pp. 227-237. Modena, 1919.

I. — In the month of May, 1915, the "Cattedra ambulante d'Agricoltura" of Girgenti (Sicily) notified the Royal Station of Plant Pathology at Rome, by sending some small branches of sumac (*Rhus Coriaria*) which were diseased, the presence of a mycosis attacking the anacardiacions family of plants in that province. Examination of material sent later and researches made on the spot by Prof. TRAVERSO in the following month of June, enabled the disease to be identified and recognised as new to Italy, although this appears not likely to assume great importance from the practical point of view.

The disease, named "leprosy" of the sumac by the author, has been found limited to the Campofranco territory (Commune of Castrofilippo) along the road from Castrofilippo to Naro. The diagnosis of the disease is the following: progressive withering and early drying up of the young branches, but particularly a brownish red colour of the leaves, which finally take on a purple colour with violet shades.

This coloration, which appears first as spots scattered more or less irregularly, sometimes spreads very rapidly to all the leaflets of a leaf; sometimes it affects only a small number of them and not unfrequently it keeps to only a portion of the leaflet, mostly round the base. In the latter case the appearance of the leaflets is very characteristic, as the violet-red portion is clearly separated, without appreciable shading off, from the healthy green part, with an extremely marked contrast.

(1) See *R.*, Nov., 1910, pp. 181-182; *R.*, Dec., 1910, pp. 357-404, 410; *R.*, March, 1911, No. 998; *R.*, April 1912, No. 1298; *R.*, June, 1911, Nos. 1892-1893; *R.*, March, Nos. 576-577; *R.*, April, 1912, No. 742; *R.*, May, 1912, No. 852; *R.*, June, 1912, No. 973; R., Dec., 1913, No. 1395; *R.*, Jan., 1914, No. 75; *R.*, Dec., 1914, No. 1184, *R.* May, 1916, No. 583; *R.*, May No. 494; *R.*, 1917, July, 1917, No. 682. (*Ed.*)

No particular deformation of the leaves is noticeable, except sometimes some slight swelling between the ribs; also the diseased leaves are more fleshy and thicker than the healthy ones. It often happens that sumac leaves, through purely physiological causes, take on a reddish colour which might be mistaken at first sight for the disease in question; but in this case the red colour is lighter and such as anyone familiar with the sumac could easily distinguish from the other phenomenon; and again, this coloration affects preferably the oldest leaves, and it is not accompanied by any thickening of the leaves.

The young branches affected with leprosy gradually turn brown and dry up, without the plant apparently suffering outwardly, so that the resulting damage amounts to no more than a more or less marked lowering of the yield.

Microscopic examination of the diseased leaves, in comparison with healthy leaves, immediately reveals a quite characteristic structural deformation which serves as a diagnosis of the disease even when the parasite that is the direct immediate cause is not in evidence; namely, greater compactness of the spongy mesophyll in the diseased leaves and, more striking, radial lengthening of the epidermal cells.

From investigations carried out, on sections of affected leaves, the author has concluded that the disease in question is caused. by *Exoascus purpurascens* (Robins) Sacc., a species observed hitherto only on *Rh. copallina* in the United States and less authentically on *Rh. pyroides* in South Africa. The fact of the discovery of this parasite in Sicily on *Rh. coriaria* is of remarkable importance, both as regards the novelty of the host and because this is the first time the fungus has ben reported not merely in Italy, but in Europe.

Should the leprosy eventually spread, the author believs that spraying with Bordeaux mixture adding molasses or some other substance to make the solution adhere better to the young leaves of the plant, will be effective.

Since his inspection at Girgenti, the author has observed in several of these sumac plantations another fungoid disease, more widespread than the preceding one but, like it, not constituting a danger, in its present state, to sumac crops. As an effect of this disease, which is also new to Italy, and which the author proposes to call "vaiolo" (smallpox) of the sumac, the diseased leaves turn slightly yellow and become covered with small spots of slightly variable appearance, according to the degree of development of the parasite causing them. Small brown-red points are first seen scattered in variable numbers between the secondary ribs of the leaflets. These points next enlarge, always keeping a more or less circular outline, and generally remain isolated. At the same time the central part of each spot becomes of a whitish colour, due to the tissues dying; thus there result small white spots surrounded by a relatively large brown-red marginal ring. Lastly there appear, in the form of small black points in the middle of the spots, the fructifications (pycnidia) of a fungus which the author, by means of microscopic and taxonomic examination, identifies

as *Septoria rhoina* (Berk and Curt). Sacc., a deuteromycete which hitherto has been found only in the United States and always on *Rh. Cotinus*.

II. — Under the same "leaf reddening" of the sumac Professors Lo Priore and Scalia describe the disease that Traverso described as "leprosy".

Lo Priore states that he studied this disease in 1907 in the west of Sicily; Scalia later observed it on the Ionian coast but, neither of these authors had published their observations.

According to Lo Priore and Scalia the disease becomes evident between May and June on the youngest twigs; when once it begins to spread it attacks the older branches. The infection mostly affects the terminal leaflets and the corresponding part of the rachis, and appears as a peculiar redness which follows the appearance of black spots on the under side, generally starting from the midrib and covering a large part of the leaflet. The blackening and then the shrinking of the common rachis causes the upper part of the leaf to fall off, and perhaps later the lower part. When the infection is early enough to involve all the buds, the growth of the plant suffers a sharp set back. Then two distinct phases may show up: *a*) the plant withers and its aerial parts die; the underground parts seldom die, and then only partially; *b*) the plant replaces the dead shoots with new ones and manages to repair part of its losses, if the infection does not spread to other buds. Cases of reinfection are not few in rainy years and on cool ground; they may be found two or three times from the middle of May up to the end of June, and cease only when the hot weather of July comes. The spots on the common rachis may lengthen and leave a part of the rachis intact, in correspondence with which the leaflets remain on after the fall of the opposite ones. Often however, as the spots gain the other side of the rachis, the upper portion of the latter shrinks and falls, with the corresponding leaflets. Infection is completed, if its course is rapid, in 10 to 15 days. In its first stage it is often localised to a small number of leaflets which become red or even black in their lower parts, as well as the corresponding part of the common rachis. The apex of the leaflets themselves may remain intact, but soon withers in consequence of the perishing of the lower portion. The infection often starts on the common rachis and reaches the base of the leaflets across their articulation. Infection of the leaflets constantly starts from the midrib, which is the first to turn red; then it spreads irregularly to one of the two longitudinal halves of each leaflet. The leaves on a single branch may appear partly diseased and partly healthy. On the same leaf there may be infected leaflets and the rest perfectly normal. The infected surfaces of the leaves show a purple red colour, quite different from the green of the healthy leaves. This alteration is accompanied by a slight thickening of the leaf due to hypertrophy of the epidermal cells and of the mesophyll elements. Soon after, the infected leaves change their colour from dark purplish red to a more pinkish colour while the surface seems to be covered with a slight waxy layer. These changes show on full-grown leaves as well as on young leaves which have

ust come out of the buds. The leaflets dry up very rapidly, however, before differentiating. Long, linear spots also of brown-red colour are visible here and there on the petioles. Corresponding with these spots a light depression may be seen, caused by the outside tissues being affected. On these organs the typical waxy covering mentioned above has never been noticed. It sometimes happens that all the leaves on a twig, still growing, dry up. The twig itself may die off without showing notable symptoms of alteration.

The structural study of the diseased organs at various stages of the progress of the disease led the authors to attribute the cause of sumac leaf-reddening to a species of *Exoascus* which they identify, while awaiting the results of later investigation, with *E. purpurascens* (Robins). Sacc., already referred to.

Comparative trials of treatment with sulphur, Bordeaux mixture and spraying with 2 % solution of iron sulphate carried out at Alcamo (province of Trapani, Sicily), have shown that Bordeaux mixture (Menozzi formula) is the most effective means of checking the disease.

266 – **Diseases of Lettuce and Passion flower new to Victoria, Australia.** — BRITTLEBANK, W. W., in *The Journal of the Department of Agriculture of Victoria*, Vol. XVII, Part 10, pp. 626-269, 2 fig. Melbourne Oct., 1919.

The present paper deals first with the appearance in Victoria of *Marssonia perforans* Ell. and Ev. first described in Ohio, United States, as cause of the lettuce disease known as " lettuce anthracnose " and which brings about the perforation of the majority of the leaves of the plant. So far as Australia is concerned, the disease was noticed in a market garden in a Melbourne suburb in which lettuce seed from the United States had been sown. Lettuces in the same garden grown from seed of a different origin were not attacked. The diseased plants were destroyed and as yet no fresh appearance of the disease has been noticed. Experiments have shown that spraying with Bordeaux mixture will hold the disease in check. Diseased plants should be pulled up and burnt.

In the spring of 1916, numerous stems of *Passiflora* were attacked by a serious disease. An examination than made, revealed that they were affected with *Botrytis cinerea* Pers., and by another disease due to a discomycete (*Sclerotinia* sp.)

In the case of *B. cinerea* it was noticed that the chief centre of infection was at the points where the stem was tied to the trellis wire which supported it. At these points the stem is often slightly damaged by the effect of rubbing and these slight wounds offer a ready opening for the fungus. The symptoms of attack in the case of the passion flower are similar to those of other plants attacked by *Botrytis*. Wilting and death of the part of the plant above the point of infection is rapid, and after death sclerotia were found under the loose bark and in the pith. Experiments in infection by placing the conidia (obtained from the sclerotia found internally and externally on infected plants)or fragments of the mycelium on slight punctures made purposely, produced prompt infection. No infection took

place when conidia or mycelium was placed in contact with unpunctured parts of the plant.

In its action the disease produced by *Sclerotinia* sp. is similar in appearance to that caused by *Botrytis* and might at first sight be mistaken for the latter. In the cultural experiments the sclerotia failed to produce ascophores. As had previously been observed in the case of *B. cinerea*, the mycelium placed in contact with sound tissues of the host plant did not cause any infection ; on the other hand it caused rapid injury and death when placed in contact with wounded tissues. It was noted that the point of attack was at ground level or slightly below it, or at the point where injuries are most likely to occur during cultivation. Sometimes, but not often, the disease was found at the forking of the stem close to the level of the ground. Both *B. cinerea* and *Sclerotinia* sp. have been largely held in check in gardens where their presence had been noticed, by cutting and burning the diseased parts of the host and subsequently carrying out repeated spraying with copper-soda sprays.

267 – ***Polyporus Tsugae* Injurious to *Tsuga canadensis*, in the United States.** — WEST ERDMAN, in *Mycologia*, Vol. XI, No. p5, p. 262-277. Lancaster, Pa., 1919.

For several years dead timber of *Tsuga canadensis* has, according to observations made in Pennsylvania, been destroyed by a peculiar rot which seemed to be constantly associated with the appearance of sporophores of *Polyporus Tsugae* (Murrill) Overholts.

The examination of a group of the conifer along the Raritan river near New Brunswick, in New Jersey, has enabled the author to prove that many of these trees were dead or dying from attacks of *P. Schweinitzii ;* some of the trees bore sporophores of *P. abietinus*, but most of the trees which had died recently bore sporophores of *P. Tsugae*, sometimes in great abundance. Further research has revealed the presence in these standing trunks of the same rot observed in stumps and felled trunks of *T. canadensis* in Pennsylvania. *P. Tsugae* had been previously reported in the United States (Vermont, New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, West Viriginia and North Carolina) occasionally on pine, and more frequently on standing or prostrate trunks, on stumps and exposed or nearly exposed roots of *T. canadensis*. Few stumps or dead trunks escape its attacks when it is present in a locality, and as its destructive action is very rapid, it constitutes a possible source of danger for stored timber of *T. canadensis*.

The existence of the rot can generally be detected, at least in the more advanced stages, by the presence of the sporophores of *P. Tsugae*.

The damage which this fungus causes in the wood, and which the author describes minutely, is characterised by the fact that it commences as a sapwood rot (though the heartwood is later attacked,) producing a porous condition with numerous white cracks in the spring wood, and black spots scattered through the whole rotted part.

WEEDS AND PARASITIC FLOWERING PLANTS.

8 – ***Cuscuta suaveolens*** **on the Onion, Carrot and other Plants in Wales, Great Britain.** — *The Journal of the Board of Agriculture*, Vol XXVI, No. 8, pp. 836-837, 1 pl. London, Nov., 1919.

The presence of a species of *Cuscuta* had been noted in 10 separate lotments in the Cardiff district, and although onions were chiefly attacked ıe parasite was also found on carrots, parsnips, turnips, bird's foot trefoil, ndwort, white clover and several grasses.

A flowering specimen of this dodder was examined at the Royal Bonic Gardens, Kew, and recognised as being *Cuscuta suaveolens* Ser. (known so under the names *C. racemosa* Mart, and *C. chiliana* Engelm.), a native Chili but frequently recorded as an alien in different parts of Europe nd America (outside Chili). It is clearly allied to *C. Gronovii* Wild., ıe common American dodder, which seems indifferent as to its hosts; ıe latter has not been recorded wild in Great Britain, but is sometimes ıltivated in botanic gardens.

It was at first considered possible that *C. suaveolens* had been introıced in onion seed from America and it even seemed likely that the appearnce of the parasite in the Cardiff district might be due to clover seed from ıili. But later, two samples of carrot seed reached the Seed Testing Station which seeds of *C. suaveolens* were found; it is believed that these samples e of French origin.

9 – **Mistletoe Observed on the Chestnut, in Switzerland.** — MOREILLON, M., in *Journal forestier suisse*, Year LXX, Nos. 9-10, pp. 164-165. Berne, Sept.-Oct., 1919.

In November, 1918, the author found good tufts of *Viscum album* L. ı *Aesculus Hippocastanum* L., in a park in the Canton of Vaud, at an titude of 508 metres.

0 – ***Sorghum halepense*** **as a Weed.** — See No. 202 in this *Review*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1 – **South Indian *Coccidae*.** — RAMAKRISHNA AYYAR, T. V., in *Agricultural Research Institute, Pusa, Bulletin* No. 87, pp. 1-50, 6 fig., 16 pl. Calcutta, 1919. GENERAL

So far the *Coccidae* have not been sufficiently studied in South dia. The author thought that it was not without interest, not only r systematic entomologists but also for planters, arboriculturists, rticulturists and nurserymen, to enumerate all the species of Coccidae far recorded in South India, with special reference to those which have me economic importance. As far as possible he has avoided, both in the xt and in the illustrations, all minute structural details or technicalities garding these insects. Out of 129 species recorded in the paper only had been previously recorded from South India. The first record an insect of this family for South India was made in 1790 and the ost recent was in 1911. Of the remaining 89 species, 18 are new to

science, the others are recorded for the first time from South India and some are new to India as a whole. There is hardly any doubt that a few of them are of foreign origin and must have been introduced into India through nursery stock, fruits, seeds, bulbs, etc.

The great majority of the species recorded in the paper were collected in the plains of Southern India, chiefly in and around the Coimbatore Agricultural College, mainly by the author himself.

RESISTANT PLANTS

272 - **A New Variety of Wheat Resistant to Attacks of the Rhynchote *Cicadula sexnotata* (= *Jassus sexnotata*) in Sweden.** — See No. 192 in this *Review*.

MEANS OF PREVENTION AND CONTROL

273 - ***Leucopis nigricornis*, a Dipteron Parasitic on Coccids and Aphids.** — SCHUMACHER F., in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. XIV, No. 11-12, pp. 304-306. Berlin, July 15, 1919.

Leucopis nigricornis is of notable importance as a parasite on coccids and aphids. Certain coccids are very largely attacked by the larvae of this dipteron. According to direct observation and bibliographic investigation done by the author, the parasite in question has up till now been found on the following hosts: —

1) Cocids: = *Eriopeltis lichtensteini* Sign. (Germany); *E. festucae* Fonsc. (Germany); *E. coloradensis* Cock. (United States); *Pulvinaria innumerabilis* Rathv. (United States); *P. acericola* Walsh. and Riley (United States); *P. floccifera* Westw. (Italy); *P. betulae* L. (Germany); *Eriococcus spurius* Mod. (Germany); *Lepidosaphes ulmi* L. (United States); *Chionaspis americana* Johns. (United States); *Ch. pinifoliae* Fitch. (United States); *Ch. ortholobis* Comst. (United States).

2) Aphids: *Aphis cephalanti* Thom — (United States); *A. gossypii* Glov. (United States); *Aphis* sp. (United States); *Pemphigus bursarius* L. (France); *P. transversus* (United States); *Macrosiphum avenæ* F. (United States); *M. sanborni* (Hawaii).

274 - **The Influence of Temperature and Other Physical Agencies on the Insecticidal Properties of Chloropicrin** (1). — BERTRAND G., BROCQ-ROUSSEAU and DASSONVILLE, in *Comptes rendus des séances de l'Académie des Sciences*, 2nd Half year, 1919, Vol. CLXIX, No. 22 (Dec. 1, 1919), pp. 1059-1061. Paris, 1919.

According to the place and climatic conditions, the activity of chloropicrin when used as a parasiticide is liable to be affected by the temperature and degree of moisture in the air. The authors have studied these circumstances and also the possible influence of light. Their experiments were mainly concerned with weevils, but were extended to other insects.

These investigations have demonstrated that in the use of chloropicrin against insects there is no need to trouble about the influence of light or shade or of the degree of humidity in the air, as these circumstances are without effect. On the other hand, temperature, very materially increases the speed of action of the insecticidal vapour as in the case of chemical

(1) See *R.*, Jan., 1920, No. 148. (*Ed.*)

reactions. Hence in practice it is very important to raise, where possible the temperature of the places where chloropicrin is being used for the destruction of insects.

275 - ***Heliothrips rubrocinctus*, a Thysanopteron Injurious to Cacao, in the Island of St. Thomas, Gulf of Guinea.** — *Boletim do Centro Colonial*, Year XI, Nos. 1-3. pp. 7-8. Lisbon, 1919.

Heliothrips rubrocinctus recently caused serious damage to some cacao plantations in the island of St. Thomas, where, up to the present, attacks of this insect have always been of limited intensity.

Experiments in the prevention and control of this insect bring out the effectiveness of spraying with the following mixture: —

Tar	2.8 gm.
Palm oil	4.6 gm.
Wood ash	4.6 gm.
Water	100 litres.

276 - **Diseases and Pests of the Tea Plant in Java.** — See No. 209 in this *Review*.

277 - **The "Lucerne Grub" (*Colaspidema atrum*) Injurious to Vegetable and Garden Plants, in France** (1). — MURATET, H., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 38, (Dec. 10 1919), pp. 970-972. Paris, 1919.

Besides the considerable ravages it occasions in fields of lucerne, *Colaspidema atrum* may cause appreciable damage in gardens and vegetable plots.

On June 26, the author noticed that the larvae of this coleopteron had overrun a garden situated at Blagnac, near Toulouse. They were found in large numbers on several plants which they had partly eaten, especially on the leaves and stems of potatoes, beans, parsley and on marguerite heads. The author then collected some of these larvae and fed them on the plants just named. He found that they attack preferably first the outer flowers of the marguerite (the tubular flowers in the centre remain intact), then leaves of beans, which were almost entirely destroyed, then parsley, only the stalks of which were devoured, the leaf blades remaining untouched. Finally, leaves of potatoes were least attacked.

The garden was between two fields of lucerne and this invasion of *C. atrum* took place after the young shoots of the second crop of lucerne in these fields had been mostly eaten up. It is therefore probable that the "grubs" had emigrated to the garden because their usual food had run short.

To reach the garden the grubs had to cross a vine but they had not attacked it. The author tried also to feed them on vine leaves, but without success.

278 – **The Coccid *Icerya purchasi* and the Coleopteron *Novius cardinalis*, its Natural Enemy, in their Relations with the Leguminosae *Genista aethnensis* and *Spartium junceum*, in Sicily, Italy.** — SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura, Acireale, Bollettino* 37, pp. 1-4. Acireale, 1919.

For some years the author had oberved on the hills in the district east of Etna that specimens of *Icerya purchasi* on plants of *Genista aethnensis* were not destroyed by *Novius cardinalis*, but the coccid grew so fast on the host that it sometimes killed the plant. Further investigations revealed, at least so far, the absolute absence of larvae of *Novius* and pupa cases on numerous plants of this leguminous plant examined at various places on the east-coast side of the Etna district. On the other hand, on specimens of *Rhamnus Alaternus* and of *Rh. buxifolius* situated sometimes near or in immediate contact with plants of *G. aethnensis* there was noticed the presence of larvae and pupae of *Novius*. On making a comparative study, on one hand of citrus fruits and other plants almost free of the insect, and on the other hand samples of *G. althnensis* affected with parasites, it was found that the larvae of *Novius* usually attach themselves to the lower side of the leaves of an evergreen species, and sometimes also to the upper surface, provided they can live shaded from the sun. Consequently, the insect does not deposit its eggs on individuals of the *Icerya* existing on *G. althnensis*, because its larvae, on account of the particular conformation of the host plant, are exposed on it to the sun's rays. The mature *Novius* feed only on some *Icerya* on the leguminous plant in question and then deposit their eggs in coccids situated on neighbouring plants wtih large leaves or tufted foliage. The host coccids of *G. aethnensis* being only partly eaten up by the coleopteron, surpass the latter in development and thus succeed, in becoming numerous parasites and drying up the plant, on the death of which most of the *Icerya* then die off, except some which emigrate in time.

Before making these discoveries, the author was informed of an intense spread of coccids on rushes (*Spartium junceum*), on the hills in the east Messina district. No pupa or slough of *Novius* has been found on any specimen of rush examined, ast his plant has a conformation identical with that of *G. aethnensis*.

From the above observations it may be deduced that the coleopteron shows its weak side, since on the two leguminous plants mentioned the *Icerya* multiplies with impunity.

On the basis of a summary examination, it may be taken that the coccid is commoner in the hilly coastal district from Messina to Catania, where the damage is of slight importance. In order to prevent its spread in the middle and higher districts — which would lead to the falling off of a forest product very remunerative to these districts, where firewood and small timber is insufficient for requirements – it is desirable to see to the destruction, in the coastal zone, of the host plants of the coccids here mentioned.

279 - ***Psyche graminella*, a Macrolepidopteron Occasionally Injurious to Vines, in Switzerland.** — FAES, H., in *La Terre Vaudoise*, Year XI, No. 49, pp. 435-437, fig. 1. Lausanne, Dec. 6, 1919.

On May 15, 1919, the author received from Sion (Valais) a package of cases containing caterpillars of the *Psyche graminella*, with a statement that the parasite was attacking part of a vineyard on the Vasère hills. In the vineyard in question, one of the warmest and best situated in the district, the shoots were devoured wholly or in part by the caterpillar, over an area of about 400 square metres.

The author advises, to combat this parasite, besides collecting the cases, the use of copper aceto-arsenite, at the rate of 400 grammes per hectolitre of Bordeaux mixture, which gives very satisfactory results.

The caterpillar was described in 1907 by VALÉRY MAYET as occasionally attacking vines; up to the present it has never been reported in Swiss vineyards, at least within the author's knowledge.

After describing the morphological and biological observations made on numerous specimens reared in the laboratory, the author adds that it is not to be feared that this insect will ever do serious damage as a parasite in Swiss vineyards. It will remain an occasional pest, attacking the young leaves only when intense drought kills or greatly hardens grass culms, which form its usual food.

280 - ***Cosmopolites sordidus*, a Beetle Injurious to Bananas in Australia.** — FROGGATT, W., W. in *the Agricultural Gazette of New South Wales*, Vol XXX, part II, pp. 815-818, 1 fig. 1 pl., Sydney, Nov., 1919.

Cosmopolites sordidus Germ. was first recorded, for New South Wales, in a banana plantation near Stoker's Siding in the river Tweed district. The district at present infested with the beetle appears to be the Condong Range, where there are a number of plantations more or less seriously attacked. It is not unlikely that the beetle will also be found sporadically in other districts. It has not been possible to determine how the insect reached Condong, but it was probably introduced with young banana plants from Redland Bay, Queensland, before the presence of the pest had been reported in the latter district and before the export of the young plants was, consequently, prohibited.

The beetle deposits its eggs on the host plant just above the ground; the resulting larvae commence to burrow downwards into the base of the stem, which later, if the larvae are numerous, is transformed into a spongy mass of tissues and finally the plant dies. When full grown the larvae change into pupae at the end of the galleries made by them inside the plant.

The description of the larva, pupa and perfect insect is given.

281 - ***Myelois ceratoniae* and *Ephestia calidella*, Microlepidoptera Injurious to Locust Beans, in Sicily, Italy.** — DE STEFANI, T., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Acireale, Bollettino* 37, pp. 5-6. Acireale, 1919.

From locust bean plants under observation at Palermo the author obtained many adults of *Myelois ceratoniae* Zell. (from the end of April to

mid-August) and of *Ephestia calidella* Guen. (from the end of April to the beginning of September).

In August the locust beans are in the process of drying on the plants. This is the period when the two microlepidoptera (family *Pyralidae*), issuing from the old fruits attack the new ones on the plants which, being gathered in, as is the custom in Sicily, during September-October, will give rise to the first generation in April. On the other hand, the individuals from dried locust beans in store, coming out between April and June, will give rise to two or three generations in the same old locust beans in the stores.

The two insects deposit their eggs only on the beans, near the rib; the caterpillars bore a small hole in the fruits and entering them begin to destroy the pulp; the damage done is severe enough to make the beans so attacked useless. Once their growth is finished the larvae leave the fruits and enclose themselves in cocoons adapted to the places where they have taken refuge.

M. ceratoniae has been got also from dates, dried figs, raisins, and fruits of *Cydonia japonica*. In the larval stage it consumes also the dried-up insects. It is found along all the Mediterranean coast, in Africa, Madagascar, and the Antilles.

E. calidella has also been found in cork trees, as well as in dried figs and raisins. Like the preceding species, its caterpillar consumes the dried-up insects. It has been reported in France, England, Austria, Dalmatia, Germany and Asia Minor.

ALFREDO RUGGERI, *gerente responsabile.*

In quoting articles, please mention this REVIEW.

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FIRST PART

ORIGINAL ARTICLES

Organisation of Agricultural Book-keeping in Denmark

by O. H. LARSEN

Professor of Rural Economy at the Royal Veterinary and Agricultural School; Head of the Central Office of Agricultural Book-keeping in Denmark.

I. — LOCAL SOCIETIES FOR AGRICULTURAL BOOK-KEEPING. — The rigin of the first local societies for agricultural book-keeping dates back o the beginning of the twentieth century and was due partly to the *ntrol societies* that have existed since 1895, and partly to *farm competitions*.

The first society of control was founded at Vejen in 1895, and in 918 there were 670 such societies having as their principal object the stering of the dairy industry. They keep check over milk production nd the content of butter-fat, also on the fodder consumed by each airy cow placed under their control and, by keeping a careful system of ccounts, they are in a position to indicate the most profitable beasts.

Sometimes the book-keeping extends to horses and a check is kept ver their feed and growth; these are the first steps towards a complete ystem of farm book-keeping.

The first society of control that attempted such an extensive system f book-keeping was that of Midt Langelant under the direction of H. C. UBORG, consulting expert. Since 1907 he has used a system of his wn which, is practically a combination of the single and double systems f entry; the daily entries are not made in the books, but on special forms. hile the inventory for the year is kept on the double-entry system,

The ledger does not contain many details, nevertheless there are pecial accounts for the more important crops, viz: cereals, root crops, ay, green fodder, as well as accounts for horses, dairy cows, heifers, nd pigs.

When balancing the stock account, this is not debited with the ruling market price of the roughage consumed, but a value is given according to its utilisation by the stock, and the accounts of the various crops are credited with the respective amounts.

Few societies of control have adopted the DUBORG system. Its drawback is the difficulty met with by the controlling officer who has too many farms under his control. He has farm work to attend to besides book-keeping, and it happens with the older societies, that the book-keeping work gets behind. The system therefore could not extend, and it has been found easier to obtain estate subsidies by founding sections of agricultural book-keeping, or local circuits within the already existing agricultural associations.

In the island of Samso there is one of the oldest bookkeeping circuits of this kind ; from 1902 till 1908 prize competitions were held there for the best-kept books concerning the various groups of crops. Similar competitions were also held in the following years in other parts of Denmark, but as the interest in complete agricultural accounts grew, so do we find in the majority of places that more branches of the farm were brought under book-keeping control. A system of account-keeping is thus evolved, much alike in principle to that elaborated by DUBORG, although at times differing a little to suit local conditions.

The agricultural society of Kolding adopted the system in 1909, and in 1910 the first independent society of agricultural book-keeping was formed in the island of Samso, this being the development that followed on the institution of farm competitions. In the ensuing years this example was followed elsewhere and since 1910 about 40 agricultural societies have adopted this system of book-keeping, either through the appointment of special book-keeping committees, or by founding independent societies for agricultural book-keeping.

In 1913, the Royal Danish Agricultural Society issued a number of books on the subject, which are very close in their form and substance to DUBORG'S ; this is therefore the system used by the majority of local societies and circuits of agricultural book-keeping.

The circuits ordinarily do their work thus :— Having first secured a sufficient number of members, the society engages an accountant who will be the consulting expert and whose duties are : —

(1) To help members to establish the system and keep the books.

(2) To guide them in making the daily entries.

(3) To control the entries and make up the monthly cash account, the work book and the fodder account.

(4) To make up the yearly balance sheet.

(5) To make a detailed analysis of all accounts at the close of the year.

The fees which the society charges its members vary from 45 to 100 *øre* per hectare (from about 6*d* to 13 ½ *d*. for 2 ½ acres) according to the area of the farm. Usually the circuits cover a small area, so that one accountant is able to visit each farm of his circuit as often as required

with the exception of the busiest time, when some assistance is needed. There are, however, circuits with more than 1000 members, and in such cases the consulting officer must have one or more assistants.

Since 1915, the societies can apply for a State subsidy amounting to half the salary, office and travelling expenses of the accountant on condition that the government standard of book-keeping be adopted and that the balance sheets be published. The number of State-subsidised circuits for the financial year 1918-19 was about 30 and included 1094 farms with a total of 44.000 hectares ; in 1919 the figures were much higher.

II. — The Office of Agricultural Book-keeping. — It was stated above that it is the rule to publish the results of the accounts of local societies. A general elaboration of the results of of all the societies has not, so far, been prepared, but attempts are being made for each district. The difficulty of elaborating as one whole all the available material for the various parts of the country is partly due to the large number of books, there being more than 1000 in 1918, partly to the lack of homogeneity in the material itself.

In the spring of 1914 the Royal Danish Agricultural Society proposed the foundation of a special office of agricultural book-keeping aiming at procuring all the data for preparing an elementary course on Danish farming. The more complete development of this proposal was entrusted to Mr. O. H. Larsen, Professor of Rural Economy at the Royal Veterinary and Agricultural School.

The principal agricultural societies, after having accepted the proposal in its main lines, constituted in conjunction with the Department of Statistics a special committee, which was to try and establish a special Office of Agricultura lBook-keeping on the lines suggested by Prof, Larsen . The fundamental idea was that this Office was principally to elaborate in a scientific manner, the books of the local societies of agricultural book-keeping, that the Office and the societies should collaborate and that only the best-kept books and those answering the purpose best, should be employed In order to secure homogeneity and reliability, the Office holds every year a course or a meeting where local accountants meet to discuss the systems on which the books are kept and the rules followed for the distribution and allotting of the expenses.

In accordance with the proposal, the first aim of the Office would be to ascertain the :

(1) Amount of capital invested and manner in which it is allotted to the various agricultural enterprises.

(2) Comprehensive budget of gross profits, working expenses, net profits and interest on the capital employed.

(3) Book-keeping of the various branches of the industry showing cost of production, general and working expenses, expenses for horses, implements, etc.

(4) Household expenses.

(5) Income of the farmer and revenue yielded by the enterprise itself.

It may be said that the Office started to work on this principle in the spring of 1916 ; during the first 2 years the work was of a preparatory nature and only in the spring of 1918 was the organisation of the scheme effected and a satisfactory collaboration secured from the local societies. For the year 1919-20 the collaboration comprises a total of 29 societies and the number of books that will have to be elaborated will probably be 350. For the 2 previous years. 1916-17 and 1917-18, collaboration was extended by 6 and 17 more societies respectively with 75 and 235 books. The first report concerning the year 1916-17 was published in the autumn of 1918, and the second, referring to 1917-18, in the autumn of 1919.

The Office is under the supervision of 7 members representing the societies and the institutions which took part in its foundation. At the head of the Office there is Professor Larsen, the daily work is supervised by the consulting accountant IVAR DOKK, who is helped by a permanent assistant and by one or more temporary officers as circumstances may require.

During the first 2 trial years the working expenses of the Office were borne by the Royal Danish Agricultural Society ; for the financial year 1918-19 it received 12 000 *kronen* (1) as State subsidy and 1800 *kronen* as the contribution of agricultural societies which are represented on the Committee. The State subsidy was raised to 15 000 *kronen* for the financial year 1919-20, while the contribution of the societies will depend on the work and whole expenditure.

The local societies of agricultural book-keeping receive besides a free supply of account books, a bonus of from 5 to 6 *kronen* for every book containing data that may be useful to the Office. On the contrary the concerns that correspond directly with it and get assistance from it for their book-keeping, pay a contribution in proportion to their size and to the extent of their book-keeping. It varies from 35 *ore* to 1 *krone* per hectare.

(1) 10 *ore* = 1 *krone* ; 1 *krone* = 1s 1^{1} 2*d*.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

282 – **The Cultivation of Duckweed for the Control of Malaria.** — REGNAULT, F., in *Bulletin de la Société de Pathologie exotique*, Vol,. XII No. 10, pp. 735-736. Paris, Déc. 10 1919. RURAL HYGIENE

When duckweed (*Lemna* spp.), completely covers the surface of marshes, it causes the larvae of mosquitoes to disappear, because these, being unable to come to the surface and breathe, die of asphyxiation. Professor LAVERAN states in his *Traité du paludisme*, (second edition, p. 654), that CENTANNI and ORTA suggested the use of duckweed for the destruction of these larvae, "it is possible that this means might be useful in some particular cases".

In 1917, the author was at Ajaccio, Corsica, and noticed in the neighbourood of that town that some few boggy marshes were covered with duckweed and, consequently, free from mosquito larvae, while a great number of other marshes contained clear water had no duckweed and were alive with larvae among which could be recognised those of Anopheles. The author put duckweed in some of these marshes, but they died; on recollecting that these will grow in water charged with organic matter, he threw in some horse and cow dung after which he sowed duckweed lentils. These multiplied and grew thicker and the mosquito larvae disappeared. When the organic matter was used up the duckweed died. The author was able to repeat the experiments several times with the same result in every case.

It should be easy to grow duckweed In the struggle against malaria it would be advantageous to employ it on extensive marshes where paraffin would be costly.

The disappearance of duckweed is one of the causes of the appearance of malaria in the countries ravaged by the war. Men and cattle have died there, the shepherd takes the place of the agriculturist, the land is grazed extensively where formerly it was intensively farmed. The water, when the organic matter is used up, becomes clear again and suitable as

breeding places for anopheles. Furthermore, the obstruction of drains and irrigation canals, the destruction of trees and cultivated fields favour the stagnation of water.

283 – **Precautions to be taken in Case of Bite by the "Lucacha" (*Latrodectus mactans*), a Small Poisonous Spider of Peru and Various Other Countries.** — See No. 334 of this *Review*.

284 – **The Effect of Milling on the Digestibility of Graham Flour.** — LANGWORTHY, C. F. and DEUEL, H. J. (Office of Home Economics, U. S. Department of Agriculture) in *Proceedings of the National Academy of Sciences*, Vol. V, No. 11, pp. 414-517. Washington, Nov., 1919.

In the United States, the bulk of the wheat used for flour is made into flour which contains 72 % of the wheat kernel, called " patent flour "; part is made into flour containing 85 %, called " entire flour " or " whole-wheat flour "; part is also made into flour which contains 100 % of the wheat kernel, known as " Graham flour ". The flour containing 72 % has a much higher digesfibility then that of the flour containing from 85 % to 100 %, as the coefficients of digestibility in Table I show :—

TABLE I. — *Coefficients of digestibility of flours of various percentages.*

	Tests by other authors.		Tests by the authors.	
	Number of tests.	Coefficients of digestibility.	Number of tests.	Coefficients of digestibility.
Flour containing 72 % :	31		43	
Protein		88.1		89.5
Carbohydrate		95.7		99.9
Flour containing 85 % :	23		16	
Protein		81.9		87.1
Carbohydrate		94.0		98.3
Flour containing : —	24		33	
Protein		76.9		84.2
Carbohydrate		90.1		94.4

The method of milling affects the size of the particles and the extent to which the walls of the aleurone cells are broken or weakened (while kneading, the walls of these cells are broken at the weak places). The authors investigated the effect of the various methods of milling on the digestibility of Graham flour. A Minnesota spring wheat was milled in 5 different ways; the flour was made into bread (with small quantities of lard, molasses, salt, ginger and baking powder), and the resulting bread was eaten by men with fruit (oranges), butter, sugar, coffee or tea, in food tests. For determining the results the usual analytical methods were employed. The results of the digestion tests are set forth in Table II, in which the flours obtained by the various methods of milling are classed

in increasing degrees of fineness. They show that the digestibility of the protein increases with the degree of fineness, as might be expected, for it has been shown (*U. S. Dept. Agric. Bull.* 751, 1919) that the protein of bran is digested to the extent of 44 % in the case of fine bran, and 28 % in the case of coarse bran; on the other hand, the digestibility of the carbohydrates varied slightly. In Table II, the estimated digestibility of the protein and the carbohydrate represent the digestibility of these constituents in the flour alone, after allowance has been made for the undigested residues of the other foods in the ration.

TABLE II. — *Fineness and average digestibility of Graham flour milled by different methods.*

Methods of millings	Percentage of flour passing through 100 sieve.	Digestibility of the flour. Digestibility of the entire ration. Protein.	Fat.	Carbohydrate.	Ash.	Estimated digestibility of protein.	Estimated digestibility of carbohydrate.
Laboratory roller mill	8.2%	72.1%	94.4%	96.0%	70.1%	70.7%	95.3%
Commercial roller mill	22.8	72.1	95.6	95.4	67.6	70.4	93.8
Steel-burr mill	32.4	79.2	95.0	96.1	73.8	78.5	95.3
Attrition mill	36.6	75.5	92.9	96.1	69.7	74.5	95.4
Stone-burr mill	39.2	79.2	96.5	96.6	78.4	78.2	96.8

285 – **Comparison of the Feeding Values of Different Bread-Making Flours.** — *Feuille d'Informations du Ministère de l'Agriculture*, Year. XXV, No. 4, p. 6. Paris, Jan. 27, 1920.

At the meeting of the *Académie de médecine* of Paris held on December 1919, the results of the researches made by Messrs. ACHARD and GAILLARD were communicated, bearing on the effect of feeding animals on different bread making cereals on their development, viz., wheat, maize, rye, barley, rice when added to the normal ration consisting of cabbages and carrots. The addition of bread flour has given various results as regard to the increase of weight and the health of the subjects.

These results could not be directly and principally attributed to the nature of the flour employed. The main conclusion that is drawn from these studies is that there seems to be no difference of any importance, as far as general nutrition is concerned, between the various types of flour. These results could not be extended to the case of man without reservation, all the more so, because in the feeding of human beings these flours are consumed cooked as bread, not uncooked as in the experiments referred to above.

286 – **Direct Replacement of Glycerol in Fats by Higher Polyhydric Alcohols.** — I. LAPWORTH, A. and PEARSON, L. in *The Biochemical Journal*, Vol. XIII, No. 3, pp. 296-300. — II. HALLIBURTON, W. D., DRUMMOND J. C., and CANNAN, R. K., *Ibid.* pp. 301-305. Cambridge, Nov., 1919.

I. INTERACTION OF OLEIN AND STEARIN WITH MANNITOL. — In the extraction of glycerin from fats by ordinary methods the by-products have a very limited application as food-stuffs. To obtain a wider application, it has been suggested, among other processes, that the fatty acids should be converted into their esters (ethyl and others). The author proposed to investigate the results of esterifying with polyhydric alcohols similar in type to glycerol ; on the other hand, Professor ROBINSON is at present investigating the esterifying with sugars and their simple derivatives. As alcohol, the authors selected for their experiments mannitol ; as fats, olive oil and stearin. They note the following facts : — By distillation of olein or stearin with mannitol, under reduced pressure, in presence of a little sodium ethoxide (which acts as catalyst), nearly all the glycerol present in the original fatty compound is expelled. The maximum yield of glycerol is obtained when the proportion of fat to mannitol corresponds to 2 molecules of the former to 3 of the latter. In both cases the other principal products of the reaction are water, a little alcohol and a substance which, in many respects, is similar to the original fat. When fat and mannitol are used in the above mentioned proportions, or when there is an excess of mannitol, the composition of the product corresponds with that of a mixture of di-oleates (or di-stearates) of mannitan and isomannide.

II. — THE VALUE, AS A FOOD, OF SYNTHETIC MANNITOL OLIVE OIL. — This product, of a light greenish brown colour, has an odour reminiscent of olive oil and has, compared with good commercial olive oil the following constants :—

Constants	Synthetic mannitol olive oil	Olive oil (natural)
Free fatty acids, calculated as oleic acid	4.0 %	2.7 %
Saponification value	159	193
Iodine value	82.4	84.7

The prolonged, feeding tests, were made with rats placed on mixed diet. Utilisation of 97.8 % for the butter + olive oil mixture ; 96.6 % for olive oil ; 95.8 % for synthetic mannitol olive oil was noted. The latter is therefore practically utilised in the same proportion as natural olive oil. Furthermore, its use is by no means injurious to health and in no way hinders growth.

287 – **Bacteriology of Egg Powders.** — *Feuille d'Informations du Ministère de l'Agriculture*, Vol. XXV. No. 4, p. 6. Paris, Jan. 27, 1920.

At the meeting held on January 6, 1920 by the Academy of Medicine Paris, the results of the investigations by Dr. A. SATORY and D., L. FLAMENT on the microbic flora of dried egg powders as sold in commerce

were published This flora is important. It is usually aerobic, and includes micrococci which do not liquefy, and others which liquify in gelatines as well as members of the *Bacillus coli group*, etc. These powders are contaminated.

The various brands on the market are not sterilised. In the preparation of creams and many dishes, these powders are not raised to a sufficient temperature for sterilisation.

CROPS AND CULTIVATION

288 – **Weather Forecasing at the Station of Agricultural Meteorology, Montpellier.** — See No. 369 of this *Review*. AGRICULTURAL METEOROLOGY

289 – **Agricultural Meteorological Investigations in Scotland.** — BEDFORD, FRANKLIN, E. in the *Journal of the Scottish Meteorological Society*, Vol. XVIII, 3rd Series, No. 26, pp. 76-83. Edinburgh, 1919.

Having noted the predominant action of the weather in connection with the annual oscillations of the yield, the author gives the results of investigations and experiments with a view to discovering the effect of adverse weather by means of appropriate cultural methods tending specially to modify the hygroscopic and thermal nature of the soil.

TEMPERATURE. — In Scotland, towards mid-February, the soil temperature, is reduced almost to 0°. to a considerable depth, The increasing rise in temperature, helped by the warm spring showers and by sunshine, but hindered by nocturnal radiation and by frequent returns of cold, is rather slow. It is only towards the end of March and the beginning of April, that a temperature suited to growth and vegetation and to bacterial activity in the soil is reached (5.6° C).

1919	Temperature at surface soil.		Temperature at 1yd depth.	
Season	Maximum.	Minimum.	Maximum.	Minimum.
March 10-19	1.67°	—1.39°	1.39°	0.61°
March 20-29	2.50°	—1.11°	1.67°	1.00°
March 30-April 8	10.61°	4.72°	6.56°	5.00°
April 9-18	14.44°	3.89°	7.78°	5.50°
April 19-28	16.67°	3.06°	11 11°	5.50°
April 29-May 8	12.50°	7.00°	10.00°	6.00°
May 9-18.	20.89°	8.33°	13.89°	8.89°

Any cultural method tending to increase the thermal reserves above 5.46° would have a favourable influence on plant development and renewed growth.

By simply using a covering stretched over a plot cultivated with potatoes, the author obtained, at certain hours in the day, temperatures superior to the minimum temperature necessary for growth, while under

the open sky, as a result of the suns' rays, the temperature remained always below 5.56° C. In the case of a protected seed-bed, the seedling stage and the succeeding phases of development are considerably advanced, and the crop of tubers can be obtained three weeks or a month earlier than usual.

Besides methods employed to hinder the effect of the sun's rays, it is possible to employ others tending to increase the thermal capacity of the soil, notably: *rolling* (according to KING the difference between the same types of soil whether rolled or not, is at a depth of 75 cm, about 1.7° C), *manuring* (increase of 1.1° C.) and good *drainage* (increase capable of reaching 2.4° C).

Concerning soil temperature, the April rains are very advantageous to agriculture ; the damp soil is a better conductor of heat, and the heat penetrates the soil more rapidly, raising the temperature in the layer where the roots grow, and where the seeds await favourable thermal conditions to enable them to germinate.

Surface tillage, done with a view to stopping the water from flowing off, and causing instead direct absorption, has also an advantageous influence on cultivated plants.

MOISTURE. The dryness at the end of the spring and in the summer, accompanied sometimes by dry southwesterly winds, may frequently cause considerable damage. From that time, there is an obvious expediency in encouraging moisture absorption in the first half of the spring in order to be able to cope successfully with the dry period which may follow.

In 1916, a clay-loam meadow was cleared in order to plant potatoes as soon as possible after ploughing and manuring. The rainfall was normal, but there were strong and continuous southwesterly winds which dried up the ground very quickly. The yield was only 12 500 kg. per hectare, with an average of 16 300 kg. for the entire district.

The production of a metric ton of potatoes necessitates about 87.5 mm. of rain, but in the example selected, the plants used only 437.5 mm. of rain, whilst the rainfall in the corresponding period, was 450 mm. more than all the moisture previously stored in the ground.

The following year plans were made to remedy these disadvantages.

Directly after the harvest in 1916, the ground was dug to 45 cm. depth, then left as fallow land during the whole winter, in a fit condition to absorb the rain easily. As a result, the following spring the moisture was 10 % superior in quantity on this plot compared with neighbouring territory. Manure was applied and spring operations on the land were carried out so as to maintain, soon after planting out, a well tilled layer of surface soil, in such a way that the stored-up water would not be drawn to the surface by capillarity, followed by loss by evaporation.

In 1917, as in the preceding year, there were unfortunately strong southwesterly winds, and, during the growing period, the total precipitation was only 375 mm. lower than that of 1916. Nevertheless, the yield was 27 600 kg. per hectare (average of 22 600 for the district) coresponding to 962 mm. precipitation. Thanks to the cultural work carried out, the rains and

reserve moisture in the soil were used to their maximum capacity and the effect can be considered due to a depth of water of 587 mm., the difference between the rainfall during the vegetation period, and the absolute quantity corresponding to the total crop.

290 – **Investigations on the Cooling of the Soil During the Night, with Reference to Spring Frosts, in Scotland.** — FRANKLIN, T. BEDFORD in *Proceedings of the Royal Society of Edinburgh*, Vol. XXXIX, Part. II, pp. 120-136, figs. 3, Edinburgh, Oct. 1919.

In studying the cooling of the soil during the night, the laws which govern this phenomenon and the consequences that it may have for cultivation, the basis almost always used is the temperature taken immediately above the grass which generally covers the ground, without taking into consideration the differences, sometimes very considerable, between these temperatures and those at the surface of the soil itself.

The author gives the results of a series of investigations which he carried out in Scotland with the object of thoroughly studying the phenomenon of the cooling of absolutely bare soil or soil more or less protected by vegetable growth. The cooling of the soil during fine nights is due to radiation, and the effects of radiation are at first counterbalanced by the conductivity of the earth which conducts heat from the deeper layers to the surface and then, when the surface commences to freeze, the latent heat of freezing water is liberated and must be eliminated by radiation before further cooling is possible. It is only when these two factors have been counteracted that radiation can directly lower the temperature of the soil. The temperature at the surface of the soil depends therefore on: — (1) The relative humidity of the air; (2) the dryness of the surface layers; (3) the temperature of the layers immediately below.

The result of the observations made, confirms the correctness of the considerations set forth above. Particularly the rate of radiation of the soil (on calm clear nights when 5th magnitude stars are visible to the naked eye) is a function of the relative humidity. The other causes (condensation, evaporation, etc.) have very little effect on the temperature of the soil.

The temperature at the surface tends to fall rapidly below the temperature at a depth of 4 inches up to the point where conduction from this depth balances radiation. When this balance has been effected, the temperature at the surface should fall at the same rate and in the same manner as at a depth of 4 inches, and if the temperature of the subsoil is high there is little probability of frost.

The difference in temperature between the surface and the layer of 4 inches which establishes the balance between conduction and radiation is probably 10° F. during the winter (when the ground is always moist and of uniform maximum conductivity), but may be as much as 20° F. after a dry period in spring or at the beginning of summer.

According to these data it appears possible to predict frosts by examining observations of the humidity and temperature of the soil taken at noon. Actually four separate values have to be predicted:—

(1) The average relative humidity during the night;

(2) The temperature at a given depth (for example 4 inches) at the time when the temperature at the surface of the soil reaches its minimum.

(3) The conductivity of the layer between the given depth and the surface.

(4) The difference between the surface soil minimum and the minimum in the air immediately above.

The author believes that, taking these phenomena into account and by using sets of electrical resistance thermometers, it will be possible in the near future, to predict with great accuracy the minimum night temperatures.

When the soil is covered with a poor heat-conducting material — radiation is considerably reduced. To determine the specific effect of various covering materials the author has made a series of observations of minimum temperatures under 6 different conditions: —

(1) Bare compact soil (control).
(2) Soil covered with a layer of ½ inch of loose raked soil.
(3) Soil covered with a layer of ½ inch of ashes.
(4) Soil covered with a layer of ½ inch of manure.
(5) Soil covered with a layer of ½ inch of dead leaves.
(6) Soil covered naturally with grass and moss.

The maximum thermal efficiency of these substances was on the average: — 3° F. for, loose raked soil; 6° F. for ashes; 6.5 F. for manure; 7° F. for dead leaves; 10° F. for natural grass and moss.

On the slopes of ditches, near hedges, in the woods, the roots of many herbaceous plants, protected by a surface layer of dry leaves, are very rarely injured by frost. If in such cases, a warm rain, say in December, raises the temperature of the soil to the extent required for growth, these plants may grow and even flower in the middle of a rigorous winter. For example the author has noticed a primrose which, owing to a period of mild weather in December, 1918, had grown through the mossy turf which protected it and managed to flower on February 10, 1919. At that time the leaves and flowers were exposed to an air temperature of 15° F., while in the soil at the level of its roots the temperature was 33° F. or 18° F. higher.

Therefore, so far as the lateness or earliness of spring wild flowers are concerned, it appears that predominance should be attributed to the temperature of the soil, while the temperature of the air has, from the same point of view, much less influence.

291 — **Considerations on the Rainfall in Indo-China and their Consequences from the Standpoint of Cinchona Cultivation in that Colony.** — See No. 331 of this *Review*.

292 — **Unseen Condensation of Water Vapour due to Trees.** — DESCOMBES, P., *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 169, No. 23, pp. 1106-1108. Paris, Dec., 1919.

When the " Association Centrale pour l'Aménagement des Montagnes " founded by the author at Bordeaux in 1904, took steps to carry on

re-forestation with the object of increasing the resources of " white coal "' the author drew attention to the hydrologic action of forests, and stated that trees cause abundant precipitations without any fall of rain. An enquiry into this statement elicited much interesting information. In California, where there is no rainfall from the beginning of June to the end of September, trees are all the time very damp, the surrounding prairies are green instead of being bare ground (Sir GARDNER REED). Lake Léman is fed by the canton of Vaud and by the Haute Savoie with a proportion of forests of 25 and 28 per cent., respectively, and delivers a quantity of water superior to that due to rain and snow (FOREL). The same occurs on the Haute-Marne-where 31 % of the country is forest. (MOISSONNET).

On Table Mountain, Cape of Good Hope, 1163 metres high Dr MARLOTH placed two rain gauges ; on the top of one he put an armful of brushwood and twigs and, at the end of the experiment which lasted 56 days, he collected 2270 mm. of water in this and only 126 mm. in the control gauge.

Dr. GEORGES V. PEREZ states that abundant unseen condensation occurs in the Canary Islands where the " tils " (*Oreodaphne foetens*) supply Mont-Verde with moisture and where the " garoe ", the holy tree of Iron Island collects enough water to supply the population of the island, which has no springs.

The above-named *Association Centrale* conducted certain experiments at various stations with a cylinder 30 m. high, lined with thick woollen cloth, and with an external surface equal to some 4 times horizontal projection. The following result is worthy of note: — The quantity of dew collected in 1919 by COURTY at the Bordeaux-Floirac observatory was about 4 times larger than the mean recorded by HOUDAILLE at Montpellier with the ordinary dewmeter.

The author calculated on the strength of numerous data the total amount of atmospheric precipitations plus that which is due to condensation on ground covered with vegetation, and situated in a mountainous zone of the Pyrenees where the precipitations average 40 inches per year and where 40 % of the soil is covered with vegetation. Taking this as the annual mean we have for the various cases : 1.16 m., " on ground completely treeless ; 1.51 m.," on ground where 5 % of the area is timbered and 5 % is scrub ; 2.97 m." on country with 30 % of forest and 1.62 m.," on ground covered with scrub to the extent of 50 %.

Reforestation requires time and its hydrologic effects are not immediate ; the experience gained by the *Association Centrale* on the Pyrenees and Alps go to show that it suffices to keep away sheep and goats for 5 years from those mountains at the cost of 5 francs per hectare to enhance the growth of many trees and scrub without entailing any hardship on the inhabitants and their flocks. Reforestation plays therefore an impor-tant part in encouraging the gradual increase in " white coal " supplies.

293 – **Hard Pan in the Apulian Soils and its Origin. Researches on Soil Chemistry in the Bari District** (1). — De Dominicis, A., from the *Annali della R. Scuola Superiore di Agricoltura di Portici*, Vol. XV, pp. 39, 1 map. Portici, 1919.

The work was carried out in the laboratory of Agricultural Chemistry of the Royal School of Agriculture at Portici, near Naples. It includes an investigation bearing on the physico-chemical composition of the soil; on the chemical nature of its ingredients; on the chemical composition of the well waters and of the materials forming various layers of the soil selected for the research and of those of the subsoil; on the amount of water absorbed by the constituents of the various layers of the soil in an environment saturated with moisture; on the percentage of water absorbed by the same after 24 hours' immersion (from 10.28 to 20.60 %) on the loss of water through evaporation after immersion (from 9.90 to 23.67 after 36 hours); on the speed and percentage of water rising through capillary action; on the physico-chemical composition of the hard pan (average of 2 samples: sandy matter 9.16, colloidal matter 2.87, calcium carbonate 87.17, organic and volatile matters 20, soluble sub stances,57).

The results of the investigation enable the author to conclude: — When it is undertaken to change the local agriculture or to intensify farming in that part of the country the most essential factor is that connected with the removal of hard pan, " crosta pugliese ". This very hard layer of calcareous crust runs uninterruptedly between surface soil and subsoil, it prevents the roots from penetrating and also interferes with that free play of the water rising or descending, which is so very providential to vegetation. This telluric phenomenon reduces to a large extent the natural fertility of that soil which is washed off the higher ground and the hillsides denuded of timber and accumulates on the plains. These conditions are more uncommon in the country round Bari, where the pan firmly adheres to the rocky tufa. In other parts of Apulia, on the contrary, as in the Tavoliere and about Barletta the subsoil is friable.

The rocky mass constituting the subsoil in the Bari territory possesses a high degree of permeability, owing to its nature of calcareous tufa of pliocene origin. Its hydric capacity, however, is limited, but is sufficient for trees. Nevertheless, rain waters do not penetrate as far down as the water circulating in the soil, which otherwise would have to rise through capillary action. This is principally due to the rainwater, which is not retained through the absorbing power of the soil and cannot penetrate the crust; consequently it runs off along the layer formed by the crust itself and gets lost through the cracks and fissures.In doing so it carries off earthy material thus causing a decrease of the depth of the arable soil. The capillary system is also very active in these rocks; this is why the removal of the crust is considered dangerous by the local agriculturists who, on the contrary, look upon it as the agent preventing the loss of the water reserves below it.

The pan rests on the top of rocky layers and is always next to the arable soil; its origin, therefore, is not connected with the farthest limit

(1) See *R.* May 1919, no. 560; *R.* July-Sept. 1919, No. 822; No. 304 of this *Review*. (*Ed.*)

of penetration of the descending water, nor with the re-deposition through evaporation of the calcium carbonate dissolved in the rising water. Where it is due to the latter circumstance its position not only should be close to the surface, but outcropping altogether ; its position on the contrary is indicated by the layer where the capillary water meets the solution running through the soil. In fact, the ingredients of both waters being found in the pan, its formation is consequently due to the reactions taking place when the two waters mix. The constituents of the crust are the colloidal substances found as hydrosols in the circulating water and the calcium carbonate which is dissolved in the capillary water : the nature of the reaction is that of the coagulations which take place through the action of the electrolytes upon the hydrosols. The proof is that no crust is to be found under the red earth (*terra rossa*) because being of lateritic nature, it is poor in hydrosols. The content and proportion of limestone in the crust are essentially due to the absorbtive powers of the coagulating agent for calcium carbonate. This is taken in the mesh of the coagulating agent, it gradually replaces the water, and reduces the reversibility and swelling of the hydrogels. The whole mass thus takes shape, becomes compact, hard and impermeable. The crust is not altogether impermeable, but the capillarity is nil ; this is due to the nature and properties of a thin coating on the surface of the crust. The formation of this limestone pan is of historic origin because its formation implies absolute immobility as regards environment : such conditions could only prevail where no agriculture existed. These coincide with the 2000 years during which, dating back to the Roman republic, the country was only pastoral.

The problem concerning the possibility and desirability of removing the pan also includes methods the application of which, would lead to a change of climate and soil ; these are : irrigation, nature of the subsoil, dry farming, use of explosives, arboriculture, reforestation, etc.

294 – **On Soil Absorption.** — RAMANN, E. and SPENGEL, A. (Mitteilung der bodenkundliche Abteilung der Königl. Bayerischen Forstlichen Versuchsanstalt), in *Die landwirtschaftlichen Versuchsstationen*, Vol. XCII, Part 3-4, pp. 127-146, 6 plates. Berlin, 1918.

In order to study soil absorption, the authors carried out some experiments concerning the exchange of bases through the action of dibasic solutions, taking permutit (1) as the starting point.

When treating this silicate with neutral double solutions of potassium, ammonium, calcium, and sodium salts, the displacement of bases which occurs has all the character of a chemical action and not that of physical absorption. The exchange of bases takes place according to the laws of chemical equivalence and, in the case of potassium and ammonium, according to the law of mass action ; in fact, for the two latter elements the curves represent-

(1) Artificial sodium zeolite, that is, hydrated silico aluminate of sodium found by GANS : this compound is notable for its absorbtive power for potassium, calcium, magnesium, manganese, iron, due to the exchange taking place between these bases and the sodium of the silicate itself, the sodium passing into solution. (*Ed.*)

ing the ratio between the ions in solution and the ratio between the bases incorporated in the silicate, practically coincide. On the contrary, with the solutions contaning sodium and calcium, the exchange of bases follows as a rule the ratio of the ions of the solution, but the predominance of this or that salt causes divergences depending on an unknown factor.

Potassium and ammonium substitute one another and completely replace the sodium and calcium of the silicate, but the substitution of potassium and ammonium in the silicate by sodium and calcium is incomplete. The ratios between the bases in solution and those in the silicate are various and thes bases, which are present in the solution in very small proportion, may be found combined in the silicate in large proportion. Taking a wider range, it may be said that absolute concentrations of salts in solution have no marked influence on the composition of the silicate and this applies also to solutions of bivalent calcium with monovalent elements. *Mutatis mutandis* the same final equilibrium observed in the case of permutit, very much akin to the soil silicates, exists in the soil itself ; in fact if we take soils in equal conditions, the ratio between the bases is constant, although in the soil solution the concentration may vary.

PERMANENT IMPROVEMENT DRAINAGE AND IRRIGATION

295 – **Electricity and Soil Improvement in Italy.** — I. Elettrocultura, in L'*Impresa Elettrica*, Year XXI, No. 11-12, pp. 451-452. Rome, 1919. — II. Royal Decree-Law No. 1995 of October 2, 1919 containing provisions in favour of the production and utilisation of electrical energy. *Ibid.*, pp. 475-477. — III. Committee for Electroculture. *Ibid.*, pp. 310-511.

I. — There is much to be done in Italy to raise all the territory of the country up to the same level of production. Northern Italy has become what it is, because the waters have been regulated and harnessed, because the soil has been generously manured, and also through the large use of agricultural implements. The agricultural and industrial problems of Southern Italy, on the contrary, will be solved through artificial lakes, forestation and through the improvement of the land. It was once considered impossible to create there any great water reservoirs and that in that part of Italy it would never be possible to produce, carry and distribute electrical energy on a large scale. Electrical enterprises have already proved that by closely studying a problem the impossible may become possible, and, within a few years, if there be no untoward events in the Italian electrical industry, Southern Italy will have hundreds of thousands of h. p. available, and it will be possible largely to provide for irrigation. There are plans for the improvement of unhealthy country which have been waiting for decades and which can be read in the fine volumes of parliamentary proceedings. As they were then studied, they could never be carried out now, as such studies were founded on ideas now obsolete. For the solution of such problems new ideas, new people and modern means are required. Electricity is bound to succeed there, because of the connection existing between the regulation of the water-courses and the creation of reservoirs and irrigation, also because of the use of electric-pumps in all irrigations and works for the drainage of unhealthy country.

II. — The Italian Government signified their intention to make elec-

trical energy available in agricultural districts for the increase of production, and have passed a decree which contains the following provisions relating to Agriculture: —

Art. 13. — Subsidies are granted for 15 years equal to those granted to all existing hydraulic syndicates for irrigation and land improvement which take currents over 2000 volts in their own cables from generating stations for use in agriculture or land improvement. A contribution amounting to 40 % of the cost for the erection of complete sub-stations is also paid by the Government. (Decree of the Lieutenant Governor of February 9, 1919, No. 185).

Art. 14. — A bonus of 0.3 lira per Kilowatt is given to the same beneficiaries referred to in Art. 13 who utilise electrical energy for the work of cultivation of arable land. This bonus will be granted annually for a period not exceeding 10 years and not after 1940.

Art. 15. — Those who undertake irrigation with water raised by electric power will be eligible for bonuses assigned by this decree or can decide to share in the awards fixed by preceding orders. (Law of Feb. 28, 1886, No. 3734; Law of Jan 10. 1915, No. 107, Lieut. Gov. Decree of May 15, 1919, No. 820).

Art. 18. — Hydraulic or improvement consortia, and consortia of farmers alone or associated, can take up concessions for the construction of central electric stations, keeping the relative accounts separate.

Art. 20. — The " Cassa depositi e prestiti " will set apart a fund for the encouragement of mechanical and electrical applications to agriculture.

III. — The Society among all proprietors of electrical enterprises in the kingdom have appointed a board for the study of electro-cultivation. The board have already initiated their work on the following programme: — *a*) Irrigation improvements by means of electric pumps; *b*) agricultural improvements as a consequence of the former, carried out with all modern machinery worked by electricity; *c*) irrigation, whether by pumping water from the subsoil, or by lifting water to be canalised and distributed for irrigation purposes; all this in connection with the problem for the systematisation of mountain basins, lakes and artificial reservoirs; *d*) motor ploughing; *e*) various applications of electric motors to different farm operations.

Of all these problems it is certain that that which concerns the regulation of water is the most important, because with it is connected the freeing of marshy country from malaria. This question should be considered in relation to the small areas, for with electric pumps, it will be always and anywhere possible at a very small cost to give the waters an outlet, whatever might be the elevation of drains, sewers, etc. compared to that of the largest water-courses, lakes or of the sea. The problem of irrigation is all important, because it would bring about increased production of grain and fodder now so scarce.

Societies for electrical enterprises in Italy have ever taken fresh initiative and in the new work before them, they may be able to do a great deal, specially if associated with the farmers.

The work of the board should be:— to collect all data regarding the various Italian regions; to give directions for the execution of works, and for the supply of electrical energy; to regulate the supply according to the energy available, to study the best machines, to undertake practical experiments even with the assistance of foreign specialists and publish the results; to make suggestions to the Government on matters of legislation; to organise exhibitions of agricultural machinery worked by electricity; to help and in every way smooth the path and encourage the initiative of the individual and above all else to carry on active propaganda.

296 – **Means whereby Soil Erosion May be Prevented in Old Plantations.** — See No. 328 of this *Review*.

MANURES AND MANURING

297 – **New Guano Deposits in the Island of Sardinia.** — De Dominicis, A., from the *Annali della R. Scuola Superiore di Agricoltura in Portici*, Vol. XV, pp. 12 Portici, 1919.

Dr. Altara discovered 6 caves containing important deposits of bat guano in the districts of Dorgoli, Oliena and Orosei. The author states that the chemical nature of this guano participates of the two types, the nitrogenous, and the phosphatic guano, and that though it contains much foreign matter it is a rich manure that can be readily utilised. The following are analytical results (17 samples) showing maximum and minimum percentages:— Water and volatile substances at 100° C: 6.20 to 25.38; organic matter 5.55 to 46.27; mineral substances 30.23 to 75.87; total nitrogen 44 to 7.14; nitric nitrogen 12 to 3.91; uric nitrogen 17 to 4.45. The average percentages are respectively: 15.09, 26.12, 58.77, 2.86, 1.27, and 1.56 %.

298 – **Production of Farmyard Manure in Union of South Africa.** — Hall, T. D. (Lecturer in Chemistry, Potchefstroom School of Agriculture), in *The Agricultural Journal of South Africa*, pp. 9-21, Johannesburg, June. 1919.

The available quantities of farmyard manure from the different classes of animals of South Africa are estimated by the author as indicated in the following Table:—

Kind of animal	Approximate number	Manure produced per annum	Value of manure
Cattle	6 000 000	46 800 000	£ 29 250 000
Horses	720 000	4 320 000	4 334 833
Mules	95 000	2 392 000	—
Asses	340 000	—	—
Sheep	35 000 000	26 250 000	28 328 125
Goats	12 000 000	9 000 000	9 917 500
Pigs	1 090 000	1 853 000	1 474 679
Poultry	10 600 000	465 000	486 312
Ostriches	747 000	—	—
Totals	**66 592 000**	**91 080 000**	**£ 73 588 449**

Sheep furnish the richest manure in fertilising constituents, while cattle produce the largest quantity and the greatest total value.

The author asserts that farmyard manure is the best complete manure for increasing the fertility of South African soils. He recommends the addition of bone meal which greatly increases its fertilising value and gives a handsome return.

299 **Beneficial Action of Farmyard Manure in Preventing the Injurious Effects of Alkaline Salts in the Soil.**— LIPMAN, C. B. and GERICKE, W. F. (California Agricultural Experiment Station), in *Soil Science*, Vol. VII, No. 2, pp. 105-120, Bibliography of 2 works. Baltimore, M. D., 1919.

Experiments in pots made in a greenhouse with barley in clay soil with the object of determining the action of farmyard manure on soil to which had been added in different series: — 0.3 % sodium chloride, 0.3 % sodium carbonate, 0.6 % sodium sulphate before sowing the first crop and additional quantities at the same rate before sowing the second crop ; four successive crops were grown ; the manure was applied at the rate of 20 to 160 tons per acre.

The results, estimated according to the weight of the crops, show the protective action exercised by the manure against the alkaline salts present ; the action varied with the quantity of manure applied and with the chemical nature of the injurious salt ; it also depended on the sum *internal surface of the soil + internal surface of the manure applied.*

More positive results were obtained against sodium chloride and sodium sulphate ; in general, they have a practical application of considerable value.

300 – **The Influence of Fertilisers on the Betanical Composition of Pastures. in the United States.** — SKINNER, J. J. (Soil Fertility Investigations, U. S. Department of Agriculture) and NOLL, C. F. (Agronomy Department, Pennsylvania Agricultural Experiment Station), in *Soil Science*, Vol. VII, No. 2, pp. 161-175, 4 fig. 2 pl., Bibliography of 5 works. Baltimore, 1919.

A pasture on loam soil received for 7 consecutive years superphosphate, sodium nitrate, and potassium chloride in a double triangle arrangement of plots with 66 mixtures of fertilisers plus 6 controls ; the total amount of fertilisers applied annually was 50 pounds per acre ; the plots were 10 feet square and were separated by 2-foot paths ; the grass was cut once a year so as to allow natural seeding. The principal forage plants were : — *Poa compressa*, predominant at the commencement, *P. pratensis*, *Phleum pratense*, with smaller proportions of white clover and red clover. At the end of the experiment *Poa pratensis* had become predominant especially in the plots which had received most nitrogen, while *Phleum pratense* was favoured by potash ; clover, however, did better in the plots where there was least nitrogen applied.

The soil of the plots receiving well balanced mixture or mixtures containing principally sodium nitrate remained neutral, whilst when no nitrogen, or only a small amount, was applied it became acid ; this, however,

did not hinder the growth of clover, although in such cases it is favoured by liming.

To sum up, the predominance of a given species of forage plant in a pasture is very probably due to the survival of those species which the fertiliser applied suits best, such fertiliser being possibly at the same time prejudicial to other species.

301 – Researches on the Velocity of Solubility of Phosphoric Anhydride in Basic Slag and Other Phosphates. — MASCHHAUPT, J. G. (Rijkslandbouwproefstation te Groningen), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation*, No. 23, pp. 57-78, figs. 5. The Hague, 1919.

The result of previous researches suggested to the author the convenience of determining the velocity of solution of phosphoric anhydride, preferably through repeated extractions (1). Through an adjustment of his own apparatus he could submit to continued extraction the phosphates under study; thus he was able to estimate the rate of solubility of phosphoric anhydride in carbon dioxide solution. The powdery state of the material, however, prevented a constant rate of solubility, but although the method is not strictly scientific, a comparison may be made between the rates of solubility of the phosphoric anhydride of various phosphates.

The results of analysis show that the rate of speed at which phosphoric anydride, contained in the following materials, is dissolved in carbonated water, decreases in the order in which the materials are here named: — Merck's tricalcic phosphate, bone meal, Algerian phosphate, 3 basic slag, 3 basic phosphates and Florida phosphate, another basic slag and "Ceres" agricultural phosphate. These results are rather unusual, because the Algerian and Florida phosphates, which have a minimum solubility in 2 % citric acid, have a satisfactory rate of solubility in carbonated water, compared with other phosphates.

The opinion is held at present that the fertilising power of Algerian phosphate is much lower than that of basic slag, while that of Florida phosphate is almost nil. If, on the contrary, we were to base the fertilising power on the rate of solubility of the phosphoric anhydride in carbonated water, we should arrive at opposite conclusions and this points to the fact that either the commonly accepted opinion, from certain aspects, is wrong, or the criterion of the velocity of solution, at least as far as carbonated water is concerned, is not sound.

The necessity for fresh and accurate manuring experiments is obvious, and these according to the author, should be made in sand washed with boiling hydrochloric acid in order to eliminate interference from the many unknown factors existing in cultivated soils. Such experiments apart from determining which would be the best criterion to go by, be it the velocity of solubility, or the solubility itself independently of the former factor, would also serve to throw fresh light on the soundness, or

(1) *See R.* 1915, No. 1010. (*Ed.*)

otherwise, of WAGNER'S method based on the solubility in a 2 % citric acid solution of phosphoric anhydride contained in phosphatic materials compared with that in carbon dioxide solution.

302 – **Agricultural Consumption of Sulphate of Ammonia and Nitrate of Soda in the United Kingdom.** — Sulphate of Ammonia Association, Annual Report, in *The Chemical Trade Journal*, Vol. LXVI, No. 1703, pp. 37-38. London, Jan. 10, 1920.

According to the Fertilisers Allocation Committee of the Food. Production Department we have the following data on the development, during the war, in the consumption of nitrogenous mineral fertilisers in the United Kingdom:

Agricultural consumption of nitrogenous fertilisers in the United Kingdom (in tons).

Year	Production of Ammonia as Sulphate of Ammonia	Production of Sulphate of Ammonia as such	Sulphate of Ammonia Exported	Agricultural Consumption of Sulphate of Ammonia	Agricultural Consumption of Nitrate of Soda
1913 . . .	432 600	(1) 372 000	324 700	(1) 40 000	(1) 80 000
1914 . .	426 400	(1) 363 000	313 900	(1) 50 000	(1) 80 000
1915 . .	426 300	(1) 350 000	294 300	(1) 64 000	(1) 40 000
(2) 1916 . . .	433 700	312 500	160 300	144 600	(1) 5 000
(2) 1917 . .	458 600	283 500	28 500	234 000	(1) 5 000
(2) 1918 . . .	432 600	331 500	38 400	269 000	(1) 10 000

(1) Estimated. — (2) Year commencing June 1.

It should be noted that the agricultural consumption of sulphate of ammonia steadily increased parallel with the decrease in the exports.

Of the 269 000 tons of sulphate of ammonia furnished to agriculture from June 1, 1918 to May 31, 1919, England and Wales consumed 166 500 tons, Scotland 67 500 tons and Ireland 35 000 tons (1).

303 – **Importance of the Sulphur Deposits of Tacna, Chile.** — *Commerce Reports*, No. 289, pp. 947-958. Washington, D. C., 1919.

Sulphur comprises about 71.2 per cent. of the total value of the mineral production of the Province of Tacna for 1916, and is in fact the most valuable single resource of the region. The sulphur mines of Tacna are among the most important in the world. The deposits are estimated at from 10 000 000 to 45 000 000 tons of sulphur.

The exploitation of these vast beds has been greatly hindered by lack of capital and proper transportation facilities. The use of sulphur in the paper manufacturing industry might attract capital from the United States and other countries, while the opening of the Arica-La Paz Railway has provided the necessary means of transport.

(1) See INTERNATIONAL INSTITUTE OF AGRICULTURE, *Production and Consumption of Chemical Fertilisers in the World*, 2nd Edition. Rome, 1914 (*Ed.*)

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

304 – **Factors Influencing Vegetation in Hot Climates.** — I. Rivera, V., Per il Mezzogiorno. Extracted from the *Rivista di Biologia*, Vol. I, No. 2, pp. 9. Roma, 1919. — II. Id. I problemi agrari del mezzogiorno. *Memorie della R. Stazione di patologia vegetale*, pp. 18. Rome, 1919.

Soil productiveness in Southern Italy is a question of climate, which is particularly hostile, through its inconstancy, to green crops, rather than a matter of soil fertility, which sometimes is all that could be desired. Generous manuring, which in the northern Italian districts largely increases the yield, may cause a decrease in the south in a dry year. The application of fertilisers containing nitrogen in a mineral form may in certain years aggravate the consequences of drought and of excessive heat, etc., by causing the drooping and drying up of the aerial organs of the plant ("wilt" of the American agriculturists).

The practices which have brought wealth to the northern Italian districts cannot be generalised in the south, where such unfavourable and uncertain conditions prevail; the question is to find out new and suitable methods, but the problem is not yet solved and in the majority of cases no initiative has yet been taken.

The green crops generally and cereals in particular are connected with the unequal distribution over the surface of the globes of the 2 principal factors in plant life, water and light; they, therefore, should find in southern Italy conditions favouring their production, but the author points out that this belief is destroyed by an analysis of the average wheat yield expressed in quintals per hectare in the wheat-growing countries of the world. The average yield per hectare appreciably decreases with a decrease of the latitude and increases with it. Against the lowest yields in Tunis, where the average of 5 years is 3.4 quintals per hectare, there are the 31.7 quintals in Denmark. Italy shows 14.5 in the north, 9 in the centre, 8.5 in the south and on the islands. What is then the cause of the greater productivity of northern countries? It seems certain that the reason must be found in the existence of certain influences, which change gradually from the equator to the pole.

The factors which favour the photosynthetic activity of the plant's green organs can be summed up as the influence of luminosity, and as this varies with the angle of incidence of the sun's rays and the clearness of the sky, one would be inclined to conclude that photosynthetic activity and production would consequently be greater in Southern countries where luminosity is more intense. This is not so: the author conducted experiments with wheat and maize and it seems that, particularly for wheat, greater luminosity causes a decrease rather than an increase in the yield; the carbohydrates stored in the plants seem to depend more on the number of hours of sunshine enjoyed by the plant, than on luminous intensity. This luminosity, which in southern climates is constantly accompanied by great heat during summer, even limits assimilation, which is the source of production.

Southern countries are not suited for herbaceous crops, and it is necessary to look for more suitable crops and not to persist in growing crops that cannot thrive.

The author expresses the hope that the Institute of Genetics created to deal specially with cereals in Italy may not limit its programme to grain crops alone, which in Southern Italy have neither a scientific, nor an economic basis. Researches should also be initiated and directed to find other crops, even more profitable than wheat, which would be benefited by the strong sunshine in these countries.

305 – **Folk-lore and Use Made of Ferns.** — PRINCE ROLAND BONAPARTE, (membre de l'Institut). in *La Nature, Revue des Sciences et de leurs applications à l'Industrie*, No. 2387. Paris, Dec. 27 1919.

During the late war fresh interest was evinced in ferns as regards the place they might fill in the national and domestic economy. The uses that Pteridophytae may be put to are not as manifold as those of the Phanerogams, nevertheless a number of instances of their usefulness are recorded. Lately Mr. MAXON of Washington published an account of the use that ferns are put to in America.

It is known that several tree-ferns of the genera *Cibotium*, *Balantium*, *Dicksonia* carry round their butt and at the base of their leaves hollow hairs which have the faculty of absorbing liquids ; for this reason they have been employed to stop bleeding. These hairs come from various countries and are known under the general name of *Cibotium* hairs.

In the old pharmacopoeias the oldest known of these remedies was called the " Lamb of Scithya ". It is " the Barometz " or Pengawar-Djambi of the Hindoos, which is obtained from *Cibotium Barometz* J. Smith, quite common in India, Java, China and Cochin-China. The most employed of late is the Paku-Kidang of Java furnished by the *Dicksonia Blumei* Moore. It is like a ball of tangled hairs ; often the hairs are free, 2 inches long, light yellow or very brown.

According to Father CADIÈRE the use of " barometz " is known in Annam. When an Annamite wood-cutter cuts himself with his axe or bill-hook he rushes to the bank of the nearest torrent for a plant of *Ciborium Barometz* J. Smith. He takes the beautiful golden yellow, silky tuft which sorrounds the bud at the apex and with it dresses the cut to stop bleeding.

LOURRIERO, in his *Flora Cochinchinensis*, makes extensive reference to this plant and its use. Through the scarcity of straw for litter, attention was drawn to the common bracken *Pteris aquilina*. For this purpose it might be gathered in the months of July and August ; good manure could be obtained from it. because of the amount of potash it contains.

In the north of England it was the peasants' custom in certain districts to burn ferns and to make balls from the ashes that took the place of soap. This species of fern is most plentiful in France ; it could be cut several times in the year, and the leaves fed to horses and cattle. It might be used in the trenches, because it does not easily get soaked and keeps sweet. The peasants of certain French districts prefer mattresses filled with ferns for their children to sleep on, believing in the fern's healing power for certain ailments. The cost of procuring this fern would al-

most be limited to that of cutting and carting, because in most places nobody considers it of any value. Other uses have been suggested for it.

The rhizome of *Pteridium aquilinum* Kuhn var. *esculenta* Forster is eaten in many countries. According to BAILY the *Platicerium grande* J. Smith, of Australia yields sugar. M. J. CLAESSEN tells us that the natives of the Belgian Congo get salt from *Diplazium silvaticum* Swartz. Father CADIÈRE reports on a variety of uses that ferns are put to in northern Annam, some of which are given betow:

The natives make with wire or bamboo rough shapes of people, birds, beast, houses, tc. They place on these the tufty rhizomes of *Davallia bullata* Wallich, which at the proper season shoot up and the foliage gives the object a most fantastic appearance. These droll curiosities are a new industry of the Annamites and there is quite a considerable export of them to England and America.

The Annamites eat the young shoots of *Diplazium esculentum* Swartz; they boil them in water like asparagus, pickle or fry them; some hold the belief that they cause fever.

The *Stenochlaena palustris* Beddome, has very long and tough rhizomes that last well in sea water; they are marketed in large bundles.

The *Adiantum flabellatum* Linnaeus, is called by the Annam natives the incense stick plant, because of the shiny black, ebonyl ike colour of the rachis. With the leaves they dress cut wounds.

They use the bark of *Gleichenia linearis* Clarke, which is tough and has a beautiful shiny brown colour, to hem the brims of their hats. The whole plant is used for the silk-worm to climb and to make rough partitions in the stables.

They consider the large rhizomes of *Polypodium coronans* Wallich cooked on embers, excellent against stomach troubles.

The *Acrostichum aureum* Linnaeus is of great economic utility to the Annamites. The fronds of this fern, when dry, get hard and parchment like; thatches are made with them for the roofs of their houses. The cost of these thatched roofs is higher than that of the straw thatches but the roof lasts longer and, above all, the danger of fire is much less. These fern leaves burn quickly, leave a very small quantity of light ashes, which quickly cool down, or blow away before setting fire to the whole of the house and the furniture; when the straw thatches on the contrary, and these take fire, everything is lost. Gathering these fronds and making thatches is the industry of certain villages.

The *Platycerium coronarium* Desvaux, is called the devil's box by the Annamites who worship or rather fear it. Its barren leaves climb up and round the trunk of the tree on which it grows; the ribbons hanging all round give the whole effect the appearance of a mysterious sunshade, suggesting the abode of some redoubtable genius. When they come across one of these *Platycerium*, they never fell the tree that supports it, even if it be the best tree in the forest, but they turn their heads away out of regard for, or perhaps from fear of offending the genius. Although this plant is met with frequently enough in the forest, Father

CADIÈRE never succeeded in getting an Annamite to show him a specimen. The plant is taboo and the profanation would bring evil on the transgressing native.

The stem of *Lygodium* supplies a binding material sufficiently strong, but not durable. Fishermen place a bundle of *Lygodium* in their nets to check the struggles of the fish inside.

Here the author ends his first account of the uses and folk-lore of Pterydophytes, which he intends to continue later, inspired in his work by that of M. ROLLAND on the popular flora of France.

306 - **Effect of Certain Organic Substances on Plants.** — CIAMICIAN, G. and RAVENNA, C. in *Gazzetta chimica italiana*, Year XLIX, Part II, vol. III and IV, pp. 83-126, figs. 20 + 2 tables Rome, 1919.

The authors studied in previous experiments (1) the influence that certain organic substances have on germination and particularly on the development of plants; they also dealt with the changes, especially auto-oxidisations, to which certain compounds are subject through the action of catalysts contained in plants. The work now under review concerns another set of experiments : in its first part they investigate the action of some more organic substances on plant growth; in the second part they deal further with the question of auto-oxidisation.

Young French beans plants were selected for the experiments, and grown on cotton wool ; this was daily moistened either with solutions of the substances which were the object of experiment, or twice a week alternately with a nutritive solution. The influence of the various solutions on the assimilation process was investigated by noting the distribution of starch in the leaves. To this end certain leaves were partially covered in the evening with a strip of black paper, so as to show up the coloration of the portions not covered ; on the following day they were collected during the hours of the most intense luminosity, dipped for a moment in boiling water, decolorised with alcohol and finally treated with a solution of iodine and potassium iodide. The starch completely disappeared from the covered portions of the leaves, if the leaves were in normal condition ; but if these were not under normal conditions or were at all sickly, the starch did not disappear altogether. By the system adopted, any alteration which the leaves had suffered was made manifest.

The substances tested and their effect on the plant were :

Monomethylamine. — Poisoning effects, though not very pronounced.

Dimethylamine. — Poisoning effects more pronounced than with monomethylamine.

Trimethylamine. — Stronger and swifter poisonous action than that shown by the two other amines ; it manifests itself in the drying up of the leaves.

Isoamylamine. — The first simple leaves dry up rapidly ; the first compound leaves appeared almost deprived of chlorophyll and soon withered.

(1) See *R.*, Dec. 1917, No. 1136 ; *R.*, Apr., 1918, No. 853 ; *R.*, Jan., 1919, No. 30. (*Ed.*)

Tartarate of tetracthylammonium. — Plants took on a peculiar appearance; slight poisonous effects.

Ammonium salts. — Normal development.

Urea. — Vigourous growth.

Guanadine. — The young plants were evidently sick; leaves faded first, then stems drooped.

Cyanamide. — Remarkable effects of poisoning; leaves fade, and growth suffers a check.

Potassium cyanate. — Growth is checked, the leaves become wrinkled, and then stems begin to droop.

Potassium cyanide. — Growth is delayed; leaves wrinkle and fade, stems remain erect.

Potassium salicylate. — It causes some delay in the growth of plants, but these reach the flowering stage and ripen some of the seeds.

Methyl salicylate. — Poisonous effect is quite plain; it manifests itself after the appearance of the second compound leaves.

Pyrocatechin. — Plants quickly show ailing symptoms, but live on though very poorly.

Guaiacol. — Growth stops when the first compound leaves are about to appear, and the young plants die off shortly after.

Aniline. — Remarkable poisoning effects manifesting themselves in the leaves; growth is checked a few days after the first treatment.

Acetanilide. — Leaves turn yellow, stems become soft, growth is checked. Plants begin to decline sooner than is the case with aniline treatment.

Methylacetanilide (Exalgine). — Poisoning effects similar to those caused by acetanilide, though more pronounced.

Indole. — Stems wither, the young plants droop and die off quickly.

Methylindole. — Effects similar to those caused by indole, though not so swift, perhaps because methylindole is sparingly soluble.

Pyridine. — Normal vigorous growth.

Piperidine. — Slight check of growth; leaves show a few yellowish spots, but the young plants go on growing vigorously enough.

Methylpiperidine. — Remarkable poisoning effects manifesting themselves through blotches on the leaves and recumbent stems.

Acetyl-piperidine. — Manifestation of poisoning effects through the fading of the leaves; stems remain upright.

Piperine. — Effects not unlike these produced by methylpiperidine; leaves fade and stems droop.

Conine. — The young plants soon start ailing; leaves dry up, but stems continue to stand straight.

Tartarate of dimethyl-piperylammonium. — Peculiar appearance of the plants similar to that caused by other quarternary bases, though less pronounced. Limited poisonous effects.

Nicotine. — Withering of the simple leaves, albinism of the first compound leaves.

Morphine. — Effects of poisoning not very remarkable.

Codeïne. — Poisoning effects more pronounced than in the case of morphine; many blotches cover the leaves which dry up.

Heroïn. — Remarkable effects of poisoning on the leaves, which turn yellow.

Papaverine. — The young plants gradually wither; leaves dry up round the margin.

Narcotine. — Effects similar to those caused by papaverine.

Cocaïne. — Leaves become covered with brown blotches, the young plants die off before the growth of compound leaves.

Atropine. — Leaves first get wrinkled, then full of spots. The more advanced young plants are very sickly, nevertheless some of them reach the flowering stage.

Sparteïne. — Leaves become full of brown blotches and dry up quickly.

Caffeïne. — Leaves become covered with yellow spots and dry up rapidly.

Theobromine. — Poisonous effects not very pronounced, which are made manifest through the albinism of the simple leaves.

Methlyl-uric acid. — Limited poisoning effects; the first symptoms manifest themselves after the emission of the second compound leaves.

Uric acid. — Vigorous development.

Quinine. — Vegetation is checked, leaves become wrinkled, stems droop.

Cinchonine. — Although less remarkable, poisoning effects are similar to those caused by quinine.

Strychnine. — Growth is checked when the second compound leaves make their appearance.

The results above reported led the authors to the following conclusions: — Methyl-radicals, far from having a protective influence on the reactive groups such as hydroxyls, amino and imino groups heighten the action of the fundamental substances that contain them. Methyl groups are not the only ones, which modify the action of organic compounds on the plants experimented upon, as other radicals manifest an action of their own, *i. e.* the propyl radical of conine, the acetyl in acetyl-piperidine acetyl-morphine and acetanilide and again the radical of the piperinic acid in piperine.

One is led to believe that plants start from the simplest fundamental compounds and that they combine with alkyl or acid groups and lateral chains detailed to special functions.

The poisonous substances experimented with, interfere in certain cases with the formation as well as the migration of starch; the leaf treated with iodine reagent takes on a peculiar and different appearance in each caseofinhibition.

The experiments described in the second part aimed principally at comparing the oxidisations determined by plant enzymes with those which CIAMICIAN and SILBER produced by the action of light (*Memorie della R. Accademia delle Scienze dell'Istituto di Bologna*, Series VI, Vol. IX, pp. 168; Series VII, Vol. II, p. 188; 1914-1915). A mash made with spinach was

mixed with the water solution of the substance under study ; the mixture was left for a while to stand and submitted to a slow current of oxygen. In a water extract of the mixture were sought the newly formed bodies.

It was noted that in general the oxidisations caused by light and those caused by enzymes are not the same ; thus toluol, which through the action of light yields benzoic acid, by auto-oxidisation undergoes no change through the action of enzymes in spinach leaves. Among the acids that were examined, oxalic acid is almost entirely oxidised through the action of light and through that of enzymes. Succinic acid under the influence of light yields small quantities of glyoxal together with acetic aldehyde, acetic and propionic acids ; through the action of enzymes, succinic acid produces neither glyoxal nor volatile acids but only acetic aldehyde, while a portion of it is changed into a compound that emulsin can split. Lactic acid undergoes auto-oxidisation through the action of light and gives aldehyde and acetic acid ; with the enzymes, lactic acid produces only the aldehyde. Light causes the auto-oxidisation of mandelic acid, which yields benzoic and salicylic aldehydes ; but the enzymes transform mandelic acid almost completely in a compound, which after hydrolysis with sulphuric acid, produces mandelic acid once more.

The action of light and also oxygen change coumarin into its dimerous form, the hydrocoumarin of Dyson ; this polarisation does not take place with spinach enzymes.

Amongst the ketones, acetone and probably also methylethylketone behave in a similar way under the influence of light or of the enzymes. The difference between the two agents was most marked when cycloketones were employed ; *i. e.* cyclo-hexanone, the isomerous 3 methyl-cyclohexanones and menthone. Light in these three cases is accountable for the hydrolysis which produces the respective fatty acids and for the oxidisation leading to the dibasic or ketonic acids corresponding to the ketone employed. With the enzymes, on the contrary, the authors could never obtain the dibasic acids corresponding to the ketone employed, but they always obtained lower fatty acids, butyric, propionic, acetic, and formic acids. Small quantities of succinic acid were also identified among the oxidisation products of menthone and meta-methyl-cyclohexanone. It is confirmed therefore that the enzymes of spinach leaves have an selective oxidising action which sometimes remains in abeyance, and in other cases goes further than that caused by light.

In living plants the oxidisation is more energetic than that produced by enzymes, which are active even in dead leaves. Substances, in fact, that greatly resist oxidisation, such as pyridine and benzoic acid, after inoculation in a maize or tobacco plant, are found but in small quantities in the extract made from them, while spinach enzymes in presence of oxygen do not affect them.

The energetic oxidising faculty of plants, especially that of living plants cannot be attributed to the known oxidases, but more probably to protoplasmic enzymes insoluble in water and to all appearances insoluble in glycerine These statements prove that plants have a very efficient way

of eliminating waste organic products, viz., oxidisation. If in some of them certain substances are found which are termed accessory, such as glucosides, alkaloids, etc., these bodies cannot be regarded as waste products, because plants would not, eventually, lack the means for their elimination.

307 – **On the Biological Meaning of Tannic Bodies. Variations of Tannin Content in the Bark of Chestnut tree According to Months and Seasons.** — De Dominicis, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, pp. 305-311. Modena, 1919.

The author reviews the controversial opinions concerning the biological meaning of tannic substances in plants; he relates his own experiments and observations on the bark of chestnut trees consisting in the determination of the content of tannin at various ages and in various months of the year and dwells on the influence of acids on the coagulation of the white of egg through the agency of tannin. He also discusses a number of facts for the interpretation of the results of his own experiments in relation to those obtained by others, and reaches the following conclusions:

As regards their origin, constitution, physical and chemical properties, tannic bodies are of the nature of glucosides. The esterification takes place between a more or less simple or complex aromatic oxyacid of fundamentally gallic and protocatechic type and a sugar, which, more frequently than not, is glucose. Biogenetic, synthetic as well as optical reasons prove this assertion.

Tannin is a strong poison for protoplasm because it is an energetic coagulant of albumin; on the other hand we see it appear, increase and remain during the germination of seeds that first contained none of it. Tannin therefore is not a reserve-substance stored up, either for the sugar that it contains, or for those compounds, which of themselves would be injurious, were they to accumulate in a free state. Tannic substances should be considered secondary products of metabolism. This interpretation with regard to tannin cannot be extended to the esterification of phenolcarbonic acids, which represent the nucleus of tannic substances. The same biologic reason does not apply to the formation of other glucosides, that is, to the neutralisation of the toxic properties of the products of plants metabolism. Gallotannic acid, in fact, is more toxic than gallic acid.

Tannin is readily absorbed by wood, gallic acid hardly at all. The easier elimination of tannic bodies in the form of glucosides, through the absorbing action of the cellulose of the wood, is not the only, nor the principal reason for their formation. Firstly, if the tannin absorbed became an intimate part of the substance of the wood, it could not be extracted by water; secondly no explanation is offered with regard to the cycle and destination of tannic bodies in plants and in their non-ligneous organs.

The results obtained by the author suggest the following explanation: — The principal reason for the formation of tannic glucosides is that these are more readily oxidised than the phenolcarbonic acid from which they are derived. Tannin in fact burns more easily than gallic acid. This is

a very important reason when viewed in connection with plants, which are without excreting organs, because it provides a means whereby plants can get rid of products, some of which are very poisonous. Thus tannin is eliminated from fleshy fruits through complete self-oxidisation, when its coagulating energy is no longer neutralised by the stabilising action of the free organic acids, which gradually disappear with the progress towards maturation. In other organs the tannin formed, or migrated thereto, is balanced by that which combustion destroys. In the case of a peripheral organ, such as the bark, directly exposed to atmospheric oxygen and to atmospheric changes, that balance is liable to be affected, as for instance, when the oxidisation of tannin increases as the temperature rises, reaching its maximum in summer's hottest months.

Tannic substances in the form of glucosides represent a waste product which the plant easily destroys, but it utilises the combustion process for vital purposes.

308 – **Relative Resistance of Various Crops to Alkali.** — HARRIS, F. S. and PITTMAN, D. W., in *Bulletin* No, 168, *Utah Agricultural College Experiment Station*, pp. 1-23 + 69 fig. Logan (Utah), July, 1919.

Different plants show considerable variation in their resistance to soil alkali. Some wild plants grow only where the salt content is high. On the other hand, most cultivated plants suffer continually in the presence of very large quantities of soluble salts ; there are a few exceptions to this rule, e. g., the date palm.

In many of the arid regions of the world the presence of alkali is one of the chief obstacles to the development of agriculture.

Between tracts completely free from alkali and those where the salt concentration is such as to prevent crops, there are very large zones of intermediate character where it is possible to introduce crops relatively less sensitive to the injurious action of alkali. The experiments described in the Bulletin under review were made with the object of studying the germination and growth of various crops in alkali soil ; they dealt with numerous species of cultivated plants and several varieties of each species.

Glass vessels were used filled with a calcareous loam soil of the " Greenville loam " series, in which the concentration of certain salts was varied. In each vessel 10 seeds were sown. Three weeks after the plants came up, they were harvested and the dry weight determined as a measure of the total growth.

SALTS USED. — Sodium chloride, sodium carbonate, and sodium sulphate in the concentrations indicated in the adjoining Table.

CROPS TESTED : — 14 varieties of oats, 8 varieties of wheat, 3 varieties of barley, rye, 7 varieties of maize, 3 varieties of millet, 5 varieties of sorghum, 8 tpes of forage legumes, 4 varieties of beans, 7 varieties of fodder grasses, 5 kinds of vegetables sugar beet, buckwheat, hemp, flax, rape.

The different varieties of oats did not show any great difference in their resistance : — *Boswell Winter*, *Red Rust Proof*, *Black* and *White Tartar*, and *Colorado No.* 9 were slightly less resistant than the others. The lower

Concentration of salts used (in millionth parts of dry soil).

Number	Sodium chloride	Sodium carbonate	Sodium sulphate
1.	—	—	—
2.	333	666	1 000
3.	666	1 333	2 000
4.	1 000	2 000	3 000
5.	1 500	3 000	4 500
6.	2 000	4 000	6 000
7.	2 500	5 000	7 500
8.	3 000	6 000	9 000
9.	3 500	7 000	10 500
10.	4 000	8 000	12 500

concentrations of salts stimulated growth, and this stimulation continued up to 1000 millionths for the chloride, 2000 for the carbonate and 3000 for the sulphate. Above these limits the number of plants obtained and their growth declined rapidly.

For wheat, similar conditions as for oats were observed. *Turkey Red* was the most resistant and *Velvet Don* the least resistant.

Among the varieties of barley tested *Black Hulless* was the most resistant and *Utah Winter* the least.

Only one variety of rye was tested and it showed itself very resistant.

The maize showed effects of toxicity at low concentrations but was, however, resistant and was able to grow considerably even at very high concentrations. In comparison with other crops it seemed to be more sensitive to the action of sodium chloride than to that of the sulphate or carbonate. Millet showed similar resistance to maize.

Among the varieties of sorghum tested, *Collier's* showed itself most resistant, and *Milo Maize* the least so. *Vicia villosa* showed tolerance for chloride.

The growth of alfalfa ceased at a concentration slightly lower than that required for stopping the growth of *Melilotus alba*.

Of the grasses, the rye grasses were the most resistant though very sensitive ; *Poa pratensis* was the least tolerant and is extremely sensitive : *Dactylis glomerata* was only slightly more resistant.

Rape was more resistant to chloride than to carbonate and sulphate ; on the other hand, sugar beets were stimulated by low concentrations of carbonate, but injured by chloride and still more by sulphate of sodium.

Kohl rabi was very resistant to sulphate at low concentrations but was very sensitive to carbonate even of low concentration, and a concentration over 3000 millionths stopped growth. Taken altogether the data collected lead to the conclusion that the application of salts at concentrations higher than 4000 millionths for chloride, 8000 for carbonate and 12 000 for sulphate is injurious for ordinary crops. These figures would have

to be modified if they were obtained from analysis of alkali soil, since the relation between alkaline chlorides and carbonates is not the same for "salts added" to the soil as for "salts extracted" from the soil.

In any case in land rich in salts the most suitable crops are cereals and the least suitable forage grasses. Of the forage crops may be recommended:— Vetches, *Melilotus alba*, alfalfa, and *Vigna Catjang*, but Timothy grass and Alsike clover are not be advisable.

309 – **Influence of the Soil and Manure on the Nitrogen and Ash Content in Crops.** — MASCHHAUPT I. G. (Rijkslandbouwproefstation te Gronigen), in *Verslagen van Lanbowkundige Onderzoekingen der Rijkslandbouwproefstations*, No. 23, pp. 40-54. The Hague, 1919.

Results for the year 1917 of the experiments started in 1909; the results up to 1916 have already been reported (1).

It is confirmed that phosphoric anhydride used as a fertiliser is little, if at all, utilised by plants on reclaimed land: the reasons of this interesting question will be the subject of further researches.

The corroboration of previous analytical data with regard to potatoes confirms the fact that systematic ash analyses makes evident the relation between the nature of the soil and the composition of the plants grown in it. This is important from the soil science and from the manurial point of view.

It is to be borne in mind that the influence of manuring on the plant ash may be properly estimated only when crops do not differ much as to the time of their harvest and as to the quantity of their yield.

PLANT BREEDING

310 – **On the Behaviour of Hybrids Resulting from the Crossing of a Mutant with the Original Variety** — FRUWIRTH, C., in *Zeitschrift für Pflanzenzuchtung*, Vol. VII, No. 1, pp 66-73. Berlin, June 1919.

The author reports on some crosses between a mutant and the variety from which it originated by mutation.

Lupinus angustifolius has seeds with brown-black, grey-green and light brown, marbled tints due to brown pigment held in a certain part of the spermoderm. The thicker the pigment-layer, the darker and more evident the marbled patches.

In 1909 the author picked out a plant of *Lupinus angustifolius* with 4 seeds of uniform grey-greenish tint. There are other seeds on the same plant with hardly noticeable patches and it was believed at first that these were ordinary instances of modifications or fluctuations, but the behaviour of the progeny and, more so, that of certain hybrids between the "variants" and the original form revealed the difference existing in the genetic composition.

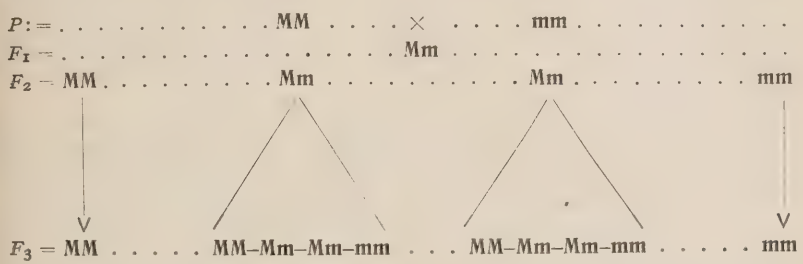
The normal type would have, besides the determinant F responsible for the spermoderm coloring in general, also the factor M because this is accountable for the distribution of the pigment itself, to which are due the peculiar marbled patches.

(1) See *R.*, 1919, No. 579. (*Ed.*)

The normal type would have the gametic formula FF MM; in the "variant" seeds, on the contrary, the factor M is lost and the formula FF mm woould express the issue.

The presence or absence of the factor M is responsible for the difference, therefore when studying hybrids between the variant and the original form, we should solely refer to this factor.

The following is the plan for F_1, F_2, and F_3 of the cross between lupin with marbled seeds (original form = MM) and the lupin with seeds of uniform tint (variant = mm).



The composition and nature of the descendants, on the whole, are are those corresponding to a monohybrid as shewn on the above plan.

Nevertheless in many cases there are exceptions to the rule and the following may be quoted: —

1) The "marbled" character is dominant in F_1 when the female parent is marbled; it is recessive when the female parent is of uniform tint. This occurs in spite of the composition Mm identical in both.

2) The dissociation in F_2 takes place without exception in all hybrids of the F_1, whether marbled or of uniform tint (constitution mm: see later).

3) In the successive, plants up to F_6, with marbled seeds may either dissociate or keep constant through their progeny; but it may happen that certain plants with the marbled seed character keep constant according to the plan, while others dissociate against all expectations.

4) Plants with marbled seeds may keep constant through one generation, dissociate in the next, and afterwards become constant again.

5) Plants with seeds of uniform and constant tint (the result of dissociation) may dissociate in 2 generations, then become constant through the successive issues.

6) In certain cases there is no rule concerning the numerical proportion of dissociation; there may be prevalence of plants with seeds having uniform tint, or there may be prevalence of the one or of the other type alternately.

These departures from the rule might be explained in the following manner: —

A) With regard to the predominance of the female parent's character, there may be 2 alternatives; —

a) M, being the male parent's progeny, has no influence on th combination **M m** and is completely separated from **m**, thus having **M ! m**

b) Spontaneous change, because factor **M**, is inactive when issue from the paternal side.

B) First generation hybrids have always the formula **M m**. I the case though of **M ! m** the issuing hybrid will have uniform tint, as i its composition were **m m**; while in **M m**, on the contrary, the issuin hybrids will be marbled with **M** dominant. In F_2 there will occur in bot cases identical dissociations.

C) Considering that a plant **M ! m** presents itself as **m m**, it is no surprising if, from individuals having seeds of uniform tint and the appa rent constitution **m m**, but really with **M n** constitution, will give disso ciated descendants.

D) At times, the normal association of the determinants remain through one generation, but is discontinued in some individuals in the ge nerations after that: thus the passage from **M m** to **M ! m**, or from **M !** to **M m** will explain the irregularities quoted in paragraphs 4 and 5.

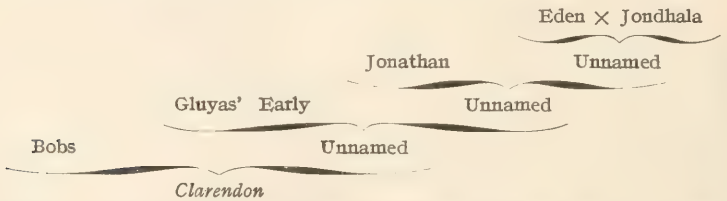
E) The possible irregularities referred to above will explain th absence of any numerical order at times connected with character disso ciation through successive generations of hybrids derived from the cros of a mutant with the original form.

In conclusion, by crossing a mutant formed through the loss o the determinant **M** alone, a monohybrid is obtained, the descendants o which can be explained on the main lines of a monohybrid plan. There are however, numerous cases that do not fall within the bounds of this plan an in all likelihood, such cases are due to spontaneous changes in **M**, or t the existence of differentiated groups **M ! m** and **M m**.

311 – **Australian Varieties of Wheat Obtained by Hybridisation and Selectio** — PRIDHAM, J. T., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Part. pp. 641-642 + 2 figs. Sydney, Sept., 1919.

Description of 3 varieties of wheat obtained by crossing and selection: – Clarendon, Hard Federation, and Warden.

CLARENDON. — The pedigree is as follows :—



Matures early: straw fairly tall, white and not very strong. Ear erec slightly awned at the tip, fairly open; glumes long and pointed; gra white, medium hard, in quality slightly superior to Canberra.

Clarendon wheat is resistant to rust, partly owing to immuni inherited from its ancestor Gluyas Early and partly owing to its earlines It is less liable to lodge than Canberra.

HARD FEDERATION :— Obtained by selection from Federation (which is believed to be the product of a natural cross), and from which it is distinguished by the ears being less dense, ; early ripening (a week earlier) ; vigour and development of the culms which, although slightly less robust than those of its ancestor, are little liable to lodging. The grain, hard and heavy, contains 11 % of gluten. Hard Federation grows well in the western and south-western districts ; in the southern districts, however, its yield is less than that of Federation.

WARDEN — The result of a cross made by PYE at Dookie College, Victoria. Its pedigree is : —

Quartz × Wards' White

Unnamed Bordeaux rouge

Warden

It is *par excellence* a forage wheat. It remains green for a long time. Ear white, erect, pointed, open ; glumes firmly attached, grain soft, elongated, pale red. It yields abundantly and is easily threshed.

312 – **Experiments in Hybridisation Between Certain Kinds of Wheat in New South Wales, Australia.** — PRIDHAM, J. T., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Part. 9, pp. 625-626 + fig. 2. Sydney, Sept., 1919.

The Federation variety of wheat is characterised by its high yield and by the robustness and fine growth of its straw ; its grain is of excellent quality.

The Cowra No. 15 variety, with somewhat complicated pedigree, has broad, dense (compact) ears, straw of medium height and an erect habit until the harvest ; its grain has slight defects in quality and structure.

The author undertook, in 1914, the cross *Federation* × *Cowra* No. 15 with the object of combining the qualities and type of grain belonging to the variety Federation with the excellent characters of Cowra No. 15. The experiment is in progress ; the F_5 generation has already been reached ; some of the selections have a brown ear like Federation, others on the other hand a white ear like Cowra No. 15, but the great majority have brown ears indicating the dominance of Federation.

The author proposes to continue his experiments with the object of isolating types and forms in which the desired characters are combined in the best proportions and in a homozygous state.

Both Cowra N° 15 and Cowra N° 19 belong to the group of FARRER crossbreeds. In 1916 these two varieties were crossed with the object of obtaining an early or moderately early type, with grain of medium soft character. As in the previous case a large number of forms was obtained and it is hoped to isolate some with the desired genetic constitution.

313 – **Synthetic Production, by Selection and Crossing of Varieties of Maize Very Rich in Gluten, in the United States.** — HAYES, H. K. and GARBER, R. J., in *Journal of the American Society of Agronomy*, Vol. II, No. 8, pp. 309-318 + 1 pl. Washington D. C., Nov, 1919.

Results of a series of experiments carried out at the Minnesota Agricultural Experiment Station, commencing in 1915, with the

object of creating a type of *Minnesota* No. 13 maize with a high protein content.

The experiment commenced with the self-fertilisation of a certain number of ears and the determination of the protein content of each; the ears with the highest protein content were used as parents for many lines: it was determined experimentally which of these lines when crossed gave the best yields. The best yielding cross was then sown in an isolated plot and selected for vigour. The results so far obtained show that the method is reliable.

In 1918, self-fertilised ears were obtained from F_1 crosses between high protein strains. A negative correlation exists between the number of grains per ear and the percentage of protein. Table I gives an idea of this correlation.

TABLE I. — *Correlation between "number of grains per ear" and "percentage of protein".*

Number of grains per ear.	*Percentage of protein.*											
	12.75	13.25	13.75	14.25	14.75	15.25	15.75	16.25	16.75	17.25	17.75	*Totals*
25	—	—	—	—	—	—	—	—	2	—	—	2
75	—	—	—	—	—	—	—	—	—	1	—	1
125	—	—	—	—	—	—	1	3	2	1	2	9
175	—	—	—	—	—	—	3	3	4	2	—	12
225	—	—	—	—	—	—	2	3	2	—	1	8
275	—	2	—	1	1	4	3	3	1	—	—	15
325	2	—	1	—	3	2	4	3	1	—	—	16
375	—	—	1	1	1	—	—	1	—	—	—	4
Totals	2	2	2	2	5	6	13	16	12	4	3	67

The correlation coefficient $r = -0.601 \pm 0.053$.

The effect of foreign pollen on the protein content, in the year in which a cross is made, is little or none, as is shown in Table II which gives the data relating to self-fertilised ears belonging to high and intermediate strains and the data relating to ears of the same strains crossed.

TABLE II. — *Average protein content in self-fertilised ears and in ears of crosses.*

Strain	Number of years self-fertilised	Average protein content
	4	14.92 %
	4	15.46
	4	16.76
	4	15.09
	4	12.97
	4	12.53
Average of 1 or 2 × 3 or 4	—	17.14
Average of 1 or 2 × 8 or 9	—	16.89

In all crosses high protein content hybrids were obtained, even when using pollen of relatively poor strains (Nos. 8 and 9 with 12.97 and 12.53 % respectively).

Table III compares some data showing that it is possible, by adopting the method proposed by the author, to obtain types of maize with percentages of protein higher than that of the original strain (in the case of *Minnesota No.* 13).

TABLE III. — *Comparison of protein contents in different types of maize.*

Strains and their crosses	Average protein content		
	in 1916	in 1917	in 1918
1	15.82 %	14.03 %	15.10 %
4	14.47	13.06	14.93
Minnesota No. 13 (original strain)	—	**10.17**	**10.25**
1 × 4 F_1 Ear *A*	—	—	12.25
1 × 4 F_1 Ear *B*	—	—	12.44
1 × 4 F_1 Ear *C*	—	—	12.81

In 1915, one hundred and twenty seven self-fertilised ears were obtained; 2 strains were isolated (Nos. 1 and 3) which had a much higher protein content than the normal, and these 2 strains preserved their characters unchanged during the period 1916-1918. In 1917, some crosses were made between these two strains and hybrids were obtained containing at least 2 % more protein than Minnesota No. 14. These crosses are also superior in yield to the original strains.

314 – **Improvement of Potatoes through Hybridisation and Selection of Bud Mutations.** — AUMIOT, J., in *Comptes rendus des Séances de l'Academie d'Agriculture de France*, Vol. V, Year 1919, No. 35, pp. 905-910. Paris, Nov. 19, 1919.

The author describes work carried out in 1919 aiming at the improvement of potatoes; his experiments included: — I) Rearing potato seedlings; II) crossing and hybridising; III) cultural bud mutations.

I) REARING POTATO SEEDLINGS. — Between April 9 and 13, the author sowed about 10 000 potato seeds in pots, keeping them on hot-beds and under frames. All these seeds were the results of crosses between cultivated varieties, others were the result of hybridisation between *Solanum Commersonii*, wild *S. Maglia* and *S. tuberosum*; a small number were the product of natural pollinisation; the experiments were therefore carried out with cross-breds and hybrids.

He obtained 3117 seedlings, which were all re-potted once and 483 of them were potted on a second time before being planted in the open. They struck roots in a most satisfactory manner. The young plants showed a remarkable hardiness and vigour during the long drought which preceded and followed the planting. Their growth was marvellous; the stems stood from 56 to nearly 61 inches high with a diameter of as much as four-fifths of an inch near the ground and carried numerous strong upright branches. The blossoming was gorgeous and lasted long; fruits were extremely plentiful. The crop was harvested at various dates, a start being made with the earlier varieties; the yield in a large number of cases corresponded to the vigorous growth. The seedlings originated from 24 crosses btween 10 varieties of cultivated potatoes and one hybrid: *S. Maglia S. tuberosum* var. Enowflack.

The vigour and productivity of cross-breds are infinitely greater than those originating from natural fertilisation and are all the greater as the characters of the parents differ. Since its introduction the potato has been propagated from tubers; this doubtless explains the extraordinary growth of cross-breds in which the effects of cross-breeding (heterozygosis) are added to those of the propagation by seed.

In the subjoined table some figures concerning the yield are given: —

Crosses	Number of tubers	Crop per plant	Weight of the heaviest tuber	Crop calculated at the rate of 33.000 plants
		kg.	gm.	kg.
Beurre × Maréchal Vaillant	70	2.730	152	89.090
Enowflack × Industrie	11	1.640	355	54.120
Beurre × Blanchard	61	1.802	90	59.466
Jaune d'or de Norvège × Beurre	—	1.750	76	57.750
Wonder of the World × Bolivienne 10 bis	40	1.667	139	55.010
Beurre × Bolivienne 10 bis	29	0.715	59	23.595
Enowflack × Beurre	28	0.860	110	28.380
Wonder of the World × Beurre	17	0.950	188	31.350

The author took into consideration other characters besides vigour and productivity, such as shape, colour of the skin and colour of the pulp. Several crosses with *Bolivienne* 10bis are proof against *Phytophthora infestans* even under really unfavourable conditions. *S. Maglia* × *S. tuberosum* var. Enowflack produces a hybrid with intermediate characters to those of the parents, although nearer to *S. tuberosum* than to *S. Maglia*.

II) Crossing and hybridising. — In 1919 the author made 1370 pollinisations and recorded 458 successful ones. The following varieties entered into the combinations : —

a) 15 *varieties cultivated in Europe :* —Industrie, Institut de Beauvais, Professor Maerker, President Krüger, Early Rose, Doctor Lucius, Beurre, Garibaldi, Reine des Farineuses, Géante Bleue, 1915 Seedling, (with long yellow tubers) Enowflack, Prince de Galles, La Tour d'Auvergne, Yellow Malta.

b) 3 *Bolivian varieties :* — Nos. 6, 10 *bis* and 17.

c) 1 mutant : *S. Commersonii* mutated in 1917.

d) 11 crosses of the year : Beurre × Marechal Vaillant, Beurre × Jaune de Norvège, Beurre × Blanchard, Beurre × Bolivienne 10*bis* Bolivienne 6 × Beurre, Blanchard × Enowflack, Blanchard × Beurre, Enowflack × Beurre, Enowflack × Bolivienne 10 *bis*, Enowflack × Bolivienne 17, Jaune d'or de Norvège × Beurre.

e) 1 *hybrid* : — *S. Maglia* × *S. tuberosum* var. Enowflack.

f) 3 *wild forms* : — *S. Maglia* Schlecht, *S. Commersonii* Dun., *S. Caldasii* Kunth.

g) 1 sort of doubtful origin : — *S. tuberosum* Sutton.

The author was prevented by mishaps and unfavourable circumstances from getting some very good varieties through to the bearing stage, but he is confident of doing so ; his material for experiments is rapidly increasing and later on he will resume his observations bearing on the genetic side.

III) Cultural bud mutations. — The experiments with mutations of tuber-bearing wild *Solanum* were extended to 200 potted plants. The observations confirmed those of previous years : — every row propagated by tuber, with the exception of some cases of retrogression, keeps the characters already acquired in its environment, or changes more and more in the mutative sense.

Number 25 (*S. Maglia* modified in 1916) has distinctly mutated to cultivated *S. tuberosum*. Its aerial and underground organ are those of the common potato. On September 13, growth being near its end, the plant was dug up, and had grown 6 small tubers on 3 very short stolons not longer than ¼ inch ; the tubers were of spheroidal or slightly elongated shape with shallow eyes, purple-red skin and white pulp.

Numbers 118, 119 and 120 *S. Commersonni C N E* have also produced " mutated " plants of beautiful appearance, healthy and even with well grouped tubers, oval or oblong, shallow eyes, yellow peel and white pulp.

The author obtained mutations that do satisfactorily under cultivation. the *S. Commersonii* mutated in 1915 and 1916 are disease-proof and yield

an average crop. Among them worthy of note is *S. Commersonii* (mutated in 1916) which is bound to take a prominent place among the varieties most largely grown ; its characteristics are :— vigour, immunity to disease, large crops ranging from 1 lb. 14 oz. to 3 lb. 14 oz. per plant, fair appearance, nice shape, good quality.

The author did not anticipate that good sorts coming well up to the agriculturist's expectations could be obtained starting from wild species with long threading stolons that carried small, non-edible tubers ; but experience shewed how this is possible by means of cultural bud mutations.

315 – **Investigations on the Variability and Heredity of the Characters of Certain to Species of *Lolium*.** — HESSING, V. in *Zeitschrift für Pflanzenzüchtung*, Vol. VII, No. I, pp. 53-57. Berlin, June, 1919.

Results of genetic and biometric investigations bearing on the variability and heredity of the characters of *Lolium italicum*, *L. italicum* var. *Westerwaldicum* and *L. perenne*.

Within the uncertain bounds of the species these plants have a great number of types and characters which, though relatively constant, largely overlap and are grouped in the most varied combinations.

The separation of varieties and of species itself is often impossible, because of such fluctuations ; take, for instance, *Lolium italicum* ; it has closed leaf-buds with laminae folded, while buds of *L. perenne* have rolled up leaves, though in many cases it is quite the reverse. There is uncertainty also with regard to the number of inflorescences, number of spikelets on the inflorescence, length and width of leaves, presence or absence of awns, length of haulms, etc :

HABIT OF GROWTH. — The author classifies into 3 groups the various habits of growth between which there are many intermediate forms :

a) Erect, V branched and fairly tall.

b) U shaped with larger and open stool.

c) Lower stool shaped almost like a rose.

They are conventionally distinguished thus : V = a ; U = b ; — = c.

Isolation and selection by pure lines proved that habit of growth is hereditary.

On a plot of *L. italicum* of the 0173 family, obtained from a U plant, out of 42 individuals 38 had the U habit ; out of 46 in the 0174 family the U type was reproduced in 42 ; finally in the family 0167 out of 55 plants 52 had the habit of growth of the parent U.

Similar results were obtained for the V type, thus 48, 54 and 56 plants, belonging respectively to the families 0227, 02230 and 0283, all issued from a V parent, plant (—), 46, 53 and 54 plants reproduced the V habit of growth.

As to (—) 55 individuals taken from family 0212 issued from a (—) parent and 53 out of that number inherited the (—) habit of growth.

WIDTH AND LENGTH OF LEAVES. — For *Lolium italicum* we have average maximum length 7.09 mm., the maximum being 9 and the minimum 5. Minimum average breadth was 3.6 with a maximum of 5 and a minimum of 2.5. mm. Maximum average length is 183 mm. with a maximum of 265

and a minimum of 120 mm. Average minimum length was 175 mm. with a maximum 195 and a minimum 101 mm.

For *L. perenne* the maximum average width is 3.09 mm. with a maximum 4 and a minimum 2 mm. The average length was 143 mm. with a maximum 255 and a minimum 115 mm.

SHAPE AND MEASUREMENT OF EARS. — Poor specimens often bear robust inflorescences which carry many flowers. Selection of these ears did not lead to a real improvement of the variety. In fact on a plot thus raised, the author obtained 68.5 % of weaklings, while out of one, on which no selection was made, the percentage was 47.63.

On many ears of *Lolium italicum* the glumes often change into spikelets, the ear thus becomlng branched. The author calls it " Ernärungsmodification " that is, a metabolic modification; nevertheless, he considers that under suitable conditions the tendency to reproduce this modification would be hereditary.

The ratio between the length of the floral axis and the number of spikelets, or in other words, the density of the ear, is also a most variable character. The following figures represent the calculated averages for *L. italicum* : —7.11 ; 8.96 ; 9.64 ; 12.64 ; 6.21 ; 11,65 ; 12.4 ; 12.11 ; 7.25 and 9.65 ; for 2 sorts of *L. italicum* var. *Westerwoldicum* the figures are 11.89 and 9.51 ; for *L. perenne* 9.3

316 – **Crosses between the French " Chevrier " Bean with Green Seeds and other Varieties.** — VON TSCHERMAK, E., in *Zeitschrift fur Pflanzenzüchtung*, Vol. VII, No. 1. pp. 57-61. Berlin, 1919.

The French " Chevrier " bean is largely grown in the neighbourhood of Paris. The tegument of the seeds, that is, the spermoderm, keeps green even when these are fully ripe ; so do the cotyledons. The shells have a tendency to keep green, fresh and succulent much longer than in other varieties. Crossing Chevrier with types having yellow cotyledons and pigmented spermoderm ♂, we will find on the same mother-plant seeds with yellow cotyledons. This is a plain example of embryoxenia.

The pigmented character of the spermoderm is dominant in F_1, but in F_2 the usual ratio remains, viz. : 3 : 1 (810 : 239 = 3.39 : 1.00).

The positive relation between green spermoderm and the permanence of chlorophyll in the ripe shells is very interesting ; this is observed in F_1 and F_2 when crossing sorts with yellow cotyledons, but there is no relation between the green of the shells and that of the cotyledons. The correlation is therefore quite restricted to organs of permanent natural origin : the spermoderm and pericarp organs originated on the female side. The valves of legumes with yellow cotyledons will keep green and tender till maturity because of embryoxenia.

In F_1 in which the white or pigmented spermoderm dominates over the green, the colour of the pods fades as maturity approaches, but they always contain seeds with yellow and green cotyledons in the ratio 3 : 1. In F_1 only plants with green spermoderm have pods always green, the colour never fading. There may be the combination of valves

that fade, with white spermoderm and green cotyledons ; it is easy to pick out the looked-for combination of green spermoderm and green cotyledons through the deep green colour, while seeds with green cotyledons inside a white spermoderm are light green in colour.

Types which are the result of dissociation, are to be found in F_2 and onwards ; the colours of their valves and spermoderm vary from light to very dark green. This might be explained by the presence of 2 factors, one with a direct and decisive action, and the other acting as an intensifier through a purely catalytic action. The ratio 3 : 1 is but apparent, the real ratio being 12 : 4.

The Chevrier French bean is a first class vegetable. Unfortunately the leaves are damaged by red spider (*Tetranychus telarius*,) while a fungus, *Colletotrichum Lindemuthianum* affects the pod and seeds.

The author is hybridising the Chevrier variety with the varieties Princess, Flageolet, Victoria, Parisien blanc, Wachsdattel, etc., in order to produce resistant and early types with larger seeds keeping at the same time the fine qualities of Chevrier. Types have already been obtained with seeds weighing. 580 gm., the seed of the original Chevrier weighing but 278 gm.

Other crosses were made between Chevrier and Heinrichs Riesenzuckerbrechbohne to create varieties with pods which would remain green until maturity (Chevrier character) that at the same time would not be stringy ; very thick and succulent (Heinrich character).

In 1919. good combinations of such characters were obtained in F_2; these types will be propagated in 1920 and then suitability for canning tested.

317 – **Genetic Factors that Determine the Formation of Anthocyanin in Peas.** — Bach, S., in *Zeitschrift für Pflanzenzüchtung*, Vol. VII, No. 1, pp. 61-66. Berlin, June, 1919.

The following gametic formulae concern the colour of the flower of *Pisum* : —

ABAB = homozygotic red
AbAb = homozygotic pink
aBaB = normal white
red × *white* = *F* heterozygotic red = **AaBB**
pink × *white* = *F* heterozygotic pink = **ABAb**.

The author carried out a series of investigations for the purpose of ascertaining whether red heterozygotic plants, having **ABaB** structure, can be distinguished from red homozygotic **ABAB** through any appreciable differences in the quality and concentration of anthocyanin. The white varieties " Victoria " ♀ and " Moerheims Riesen " ♀ were crossed with red *Pisum arvense* ♂ and with the pink flower variety " Rote Kronen " ♂. For reference and comparison, besides the 2 above-mentioned homozygotic types the " Niedrige Violette " variety was also taken as a control.

Small pieces of petals were cut weighing 10 mgm. altogether; these were

put in a calibrated tube containing 4cc. of 96 % alcohol, and the tube was closed.

The petals lost their colour after 24 hours, when it may be said that all the anthocyanin had passed into the alcohol. The colour test was easily made with the naked eye by looking at the two alcohol extracts against white paper. The one deeper in colour was diluted with more alcohol till the tint in both was even. The ratio of anthocyanin concentration was established on the proportion of alcohol used for the dilution of the deeper colour.

If extract *A* was deeper in colour than *B* and the alcohol required to bring it down to *B* was 0.8 cc., then the anthocyanin concentration in plant *A* was 3 times that in plant *B*. After even concentration was obtained, the tint underwent further examination as to tone ; for this second colour test the author employed Milton Bradley's colour scale.

Results obtained. — 1) Colour intensity in flowers of heterozygous individuals was equal or higher (1 ½ times) and even lower than the red of homozygous flowers. As far as concentration is concerned, there was therefore no difference between the 2 types; the discrepant analytical data are within the normal limits of the faculty of modification. The colour tone was identical in any case ; the quantity and quality of anthocyanin was consequently absolutely the same in both red homozygous and red heterozygous types.

2) The extract of the pink variety of the " Rote Kronen " was in any case 2 to 8 times less concentrated than the homo-and heterozygous reds.

The 2 red and pink types do not only differ as to colour intensity; there is a difference in the quality of anthocyanin as well: in fact when the 2 solutions are, through dilution, brought to have the same concentration, a considerable difference is noticeable in the colour tone. There are 2 colours instead of one and when examined with the aid of Bradley's scale, we find that red is nearer to Violet Red No. 1 and pink is closer to Violet Red Tint No. 1. The 2 homo- and heterozygous types differ consequently in both colour concentration and pigment.

The factor *B* which is present in both red and white flowers and which can change " pink " to " red ", rather than concurring to intensify the colour produced by factor *A*, is responsible for the formation of a new colouring matter.

318 – **On Some Attempts to Cross-Pollinate Peas and Beans.** — Bach, S., in *Zeitschrift für Pflanzenzüchtung* Vol. VII, No. 1, pp. 73-74. Berlin, June, 1919.

Castration of 10 flower-buds of the pea variety " Victoria " ; 7 of them were artificially fertilised with pollen of *Vicia Faba*, 3 were not treated, all were protected with a parchment paper covers. After 48 hours the stigmata were cut off 3 of the pollinated flowers, fixed in Fleming's solution, and embedded in paraffin. The 7 flowers left were kept for eight days in their paper bags, when they produced pods from 1 to 2 cm. long. and from 0. 4 to 0.6 cm. wide ; the pods were seedless, and soon dried and fell off.

Microscopic examination of the stigma showed that only some of the pollen grains had produced a pollen tube, which was very short, 10 μ at most and was unable to penetrate the tissues of the stigma itself.

We have here the corroboration and cytological explanation of the negative results which attended GÄRTNER and TSCHERMAK's hybridising attempts. The small seedless pods were of parthenogenetic formation.

The impotence of the pollen of *Vicia Faba* might be explained, the author thinks, by the want of the special chemical stimuli required for the growth of the pollen tube and for enabling it to penetrate.

319 – **On the Heredity of Red and Yellow Colours in *Beta*.** — LINDHARD, E. and IVERSEN KARSTEN, in *Zeitschrift für Pflanzenzüchtung*, Vol. VII, No. 1, pp. 1-18. Berlin, June, 1919.

Plants used in experiments: Eckendorf red beet, Des Barres yellow beet, white sugar beet, *Beta maritima*, and *B. cicla*.

We have in every case a determinant for yellow, the presence of which is indispensable for the manifestation of any colour. R red and Y yellow, together, give red; Y by itself produces yellow, while R by itself gives no colour.

The gametic formula of a heterozygous plant in relation to Y and R will be **R r Y y** (F^1) and its descendants would be: —

1	**R R Y Y**	*red*	constant *red*.
2	**R R Y y**	*red*	dissociation in 3 *reds* : 1 *white*.
1	**R R y y**	*white*	constant *white* with *red* determinant.
2	**R r Y Y**	*red*	dissociation in 3 *reds* : 1 *yellow*.
4	**R r Y y**	*red*	dissociation in 9 *reds* : 3 *yellows*, 4 *whites*.
2	**R r y y**	*white*	dissociation in 3 *whites* with factor for the *red* and 1 *white* without such factor.
1	**r r Y Y**	*yellow*	constant *yellow*.
2	**r r Y y**	*yellow*	dissociation in 3 *yellows*, 1 *white*.
1	**r r y y**	*white*	constant *white*.

On the strength of these formulae the observations of the author are easily explained. Nevertheless in certain cases the number of individuals, the colour of which do not correspond with the anticipated proportions, is larger than the mean probable error.

Thus, from a plant with the constitutional formula **R r Y Y** in F_3, were obtained 120 red individuals and 669 yellow, this being the ratio 2.578 : 1.422, rather than 3.00 : 1.00. The deviation is therefore ± 0. 422 or 11 times greater than the average probable error corresponding to 2000; there is consequently a large surplus of yellows.

In series 9-13 heterozygous hybrids with regard to the 2 determinants **R r Y y** should produce reds, yellows and whites in the ratio 9 : 3 : 4, that is, the ratio between reds and not reds, should be 9 : 7. In reality the ratio was 8 : 43 : 7.57 with an evident shortage of reds; thus the deviation was + 0. 57 or 4 times larger than the calculated average probable error

Such occurrences are explained with the coupling of factors, "Factorenkoppelung", thus hybrid **R r Y y**, instead of producing the 4 ga-

metic forms R y, R Y, r Y, r y in equal numbers, gives through the combination R y and r Y a frequency n times greater than that corresponding to R Y and r y.

Instead of 9 reds : 4 yellows : 4 whites, we should have the ratio: —

$2\ n^2 + 4n + 3$ reds : $n^2 + 2n$ yellows : $n^2 + 2n + 1$ white.

Considering the cases as a whole we find n between 1.65 and 1.75. There is therefore coupling of R with y and r with Y, but the coupling is not perfect as it requires the combination of Y R and r y according to a percentage of "crossing over" equal to 36-38 %.

CEREAL AND PULSE CROPS

320 – **Effect of Temperature on the Quality of Sweet Maize.** — STEVENS, N. E. and HIGGINS, C. H., in *Journal of Agricultural Research*, Vol. XVII, No. 6, pp. 275-284 + 4 figs. Washington D. C., Sept., 1919.

The temperature at which sweet maize remains exposed after harvest has considerable influence on its quality. It is generally admitted that sweet maize canned near the northern limit of its cultivation is sweeter than that which is canned farther south. From the investigations of STRAUGHEN and CHURCH it appears that the sugar content of the same variety of maize when harvested is approximately the same in Florida, South Carolina, New Jersey and Connecticut. The factor which eventually has an influence on the concentration of sugar would be the temperature during the period of preparation of the produce for commerce.

The authors, working on these, lines have been able to determine that;— (1) Maize deteriorates rapidly after it is picked (loss of sugar) and that; (2) the rate of deterioration is greater when the temperature is higher.

The variety "Stowell's Evergreen" (Maryland) when freshly pulled contained from 4.59 to 4.74 % of sugar. After 24 hours at room temperature, one-third of the sugar had disappeared and the loss continued until the sugar content fell to 1.80 %. At a temperature of 30° C. more than 40 % of the sugar was lost in 24 hours.

To show that the deterioration of the quality of the grain is in direct relation with the temperature the authors made the following experiments: —

Some ears of freshly picked maize (variety "Early Bantam") were split lengthwise; one half was left in room temperature (about 20° C.) and the other half was placed in a refrigerator and kept at a temperature of 10° C.

An analysis of the percentage of sugar made after 26 to 30 hours showed that the percentage was much higher in the halves kept in the refrigerator.

Given the existence of a relation between the temperature and the sugar content of maize, it is very easy to explain why sweet maize canned in relatively cold regions is superior in quality to that canned in relatively hot regions.

In Maryland sweet maize is canned in August at an average temperature of 23.67° C., while in Maine canning is done in September at an average temperature of 15.28° C. The difference between these temperatures explains the difference in the quality of the produce generally noted.

Percentage of sugar in the respective halves of each ear.

Ear N°	Percentage of sugar in the half kept at 20° C.	Percentage of sugar in the half kept at 10° C.
	%	%
11	2.43	4.06
12	1.90	3.14
13	2.28	5.54
14	1.90	3.71
16	1.86	3.18
17	1.78	4.21
Average	2.02	3.97

FIBRE CROPS

321 - **Kapok in French West Africa.** — CHARTIER, J., in *Bulletin économique de l'Indochine*, Year XXI, New Series, No. 138, pp. 784-786. Hanoï-Haïphong Sept.-Oct., 1919.

During the war kapok was much in demand by the French Admiralty and its use since has become more general. Kapok is common all through tropical Africa, but it is only during the last few years that quite a trade started in a small number of colonies. All the kapok imported in Europe is for the greater part supplied by British India and the Dutch East-Indies. Indo-China (Cambodia and Tonkin) produces it, but it is all used locally ; there is kapok also in Mexico and Brazil. Among the late German colonies attention was given to kapok in German East Africa ; Togo also exported a few tons in 1912 and 1913.

From the upper Sénégal-Niger 962 kg. were exported in 1911, 8 tons in 1912 and 28 tons in 1913.

Kapok has been exported from the Ivory Coast since 1913 and though figures are so very small, they point to the beginning of a trade that has great possibilities What has been attempted in these 2 colonies could be tried in all French West Africa where kapok trees are most common ; they grow wild from the Gulf of Guinea to the limit of the Sahara or mid-Sahara zone. The 2 principal sorts are the bombax and the ceïbas, both gigantic trees Bombax yields a clear snowy white wad; ceibas produces greyish or light red material of lesser value than the former, but being very plentiful this crop is not to be overlooked.

In 1913 the Colonial government forbade the cutting of kapok trees in order to preserve a wealth of which native inhabitants were unaware.

The author describes methods for gathering kapok Bamboo rods by carrying a wooden hook at the end to gather the hanging crop instead of being satisfied solely with the picking of the over-ripe fruit fallen to the ground ; pickers should be supplied with bags to avoid packing in leaves. For want of a small threshing machine the old Malay system might be used consisting in thrashing and shaking kapok on a bamboo flooring. The bamboo canes are not quite closely laid, so they allow kapok seeds etc. to fall through the space left between them. A great future awaits the industry in French West Africa if, as old plantations are exhausted, new planting is carried on without neglecting

plant selection. Bombax propagated by cuttings produces kapok after 5-6 years, raised from seeds after 8-10 years.

22 – **The Fan-Palm of Southern Annam and its Fibre.** — I. Petite préface de CHEVALIER, AUG. (Directeur de l'Institut Scientifique de Saïgon). — II. BUSSY, P., in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, pp. 377-380. Saïgon, Dec., 1919.

I. — In Annam and Cochin-China there is a palm with flabellate leaves, which fills a great place in the natives' domestic economy. The native name of these leaves is " La-buôn " and they are used for thatching roofs, for making various kinds of baskets and a sort of sunshade. Sails are also made out of the younger leaves ; these are divided into strips, which are sewn together afterwards ; the sampans sailing along the coast of Annam are fitted with these sails. Older leaves, first made into strips, then sewn together and bleached are used for making partitions, which separate the rooms in an Annamite house.

LOUREIRO knew the native " La-buôn " industry, as well as the native name of the leaves ; he had heard of this palm living in the forests of the Moïs country, but he had never seen it. He described it and called it *Pandanus laevis*, wrongly classifying this palm as *Pandanus* and identifying it with *Pandanus moschatus* syn. *laevis* by RUMPHIUS.

" La-buôn " really is a palm of the genus *Corypha* and, if its old specific name were traced, we should have the following synonymy: — *Corypha laevis* (Lour.) A. Chev. (*Catal. Jard. bot. Saïgon*, May, 1919, p. 56) = *Pandanus laevis* Lour. = *Corypha Lecomtei* Beccari.

Corypha laevis is common in the forests of Southern Annam and north-western part of Cambodia ; it is the " Tréang " of the Cambodian natives. Unknown in the forests of Northern Annam and Tonkin., there its place is taken by a *Livistona*, a palm whuch is grown on a large scale, especially in central Tonkin.

The following account concerns only the fibre of *Corypha laevis* of Southern Annam and North-western Cambodia ; the information was supplied to the " *Institut scientifique* " by the Annam Forestry Department.

II. — The author tried experiments aiming at utilising " La-buôn" fibre as a textile. He obtained it from the leaf-stalks and blades of 2 lots : one was made of full grown leaves, already partly dry, the other lot was made of leaves that were still closed.

Throughout the leaf, the fibres are grouped in bundles and bound by different pectic and nitrogenous substances, vasculose, cutose, etc. which must be removed by suitable solvents, which should not appreciably alter the colour and resistance strength of the fibre.

The author describes the different processes, by which he extracted fibre from the petioles : —

1) Mechanical treatment by breaking the leaf-stalks with a wooden mallet ; 2) treatment with steam ; 3) chemical treatment. The best chemical for the purpose was sodium carbonate 10 % strong, cold, or heated under 6 ½ lb. pressure.

From the trials made the author arrived at these conclusions: — bundles of fibre of great length may be mechanically prepared by moderately beating leaf-stalks with a wooden mallet and so avoiding much waste. However the fibre that falls out during this treatment may be worked into fairly strong ropes. Of all processes steam treatment under pressure and the prolongued steeping in a weak solution of sodium carbonate are those that least affect the resistance of the fibre.

Leaf-stalks and leaves, whether full grown or still closed, might be utilised for the extraction of long staple and, if the latest appliances were employed, this might yield some of the best textile materials.

323 – **Investigation of "Marine Fibre", the Fibre of *Posidonia australis*.** – READ, J. and SMITH, H. G., in the *Commonwealth of Australia, Institute of Science and Industry. Bulletin* No. 14, pp. 40, bibl. of 66 works, plates 20. Melbourne, 1919.

The fibre has its origin in the leaves and stems of the monocotyledonous plant, *Posidonia australis* (N. O. Naiadaceae), which so far has been recorded from the foreshores of Western Australia, South Australia and New South Wales and from Tasmania; but it probably extends around the whole continent. It is a submerged marine flowering plant.

The fibre is pale brown in colour, being of a lighter shade and coarser than coconut fibre ("coir" taken from the outer coating of the coconut) to which it bears a general resemblance. The fibre bundles are short (5 to 20 cm., generally 10 to 17 cm.); with an average tensile strength of 20.15 kg. per sq. mm., and an elongation of 5.29 % (variable). They are of a very brittle nature. The length of the filaments is from 5 to 1 mm.

The chemical structure of marine fibre corresponds with that of lignocellulose, intermediate in character between jute and wood ligno-cellulose, but it is characterised by its marked resistance to dilute alkalis, and to cellulose solvents and by its unusual affinity for dyes, especially basic colouring matters.

The *Posidonia australis* cellulose is obtained in a 55 % yield when the fibre is submitted to the chlorine sulphite process. It resembles esparto and straw cellulose both in its high furfural value and in its length.

The raw material yields 7.5 % furfural, and 9.2 % crude cellulose But the cellulose of *Posidonia* yields no colour with aromatic amines compared with esparto cellulose, etc. The treatment of the cellulose with a 17.5 % solution of caustic alkali gave 79.2 % of cellulose, which gave in its turn 2.9 % furfural.

In this respect is it is very similar to esparto cellulose.

The workable area of the South Australian *Posidonia* deposits has been estimated at 4600000 tons of fibre, which, washed and purified with acids. could be landed at a European port at £19 per ton. The shortness, coarseness, and lack of flexibility and cohesion as well as the structural characteristics of the filament, are all opposed to its employment in the fabrication of fine textiles.

In the fabrication of lower grade fabrics, marine fibre can be mixed with wool, and is advantageous owing to its low heat conducti-

rity. For coarse textiles, marine fibre is inferior to jute with regard to mechanical properties, but owing to its resistance to the action of chemical and bacterial agents, it would be of especial use in the manufacture of coarse fabrics, which might be required to withstand continued exposure to weather.

Although the structural attributes of the filaments are unfavourable for textile purposes, a marked degree of success has been obtained by means of preparatory treatment with dilute acids. The flexibility, and also to some extent the tensile strength show an increase if the fibre is treated for several hours with a solution of 2 % nitric acid; other acids have a similar effect although less marked. After this treatment, the loss in carding is less owing the increase of elasticity.

As a source of explosives, marine fibre has given negative results. When a method for the separation of filaments has been found, the best use for *Posidonia* will be in paper making. The close resemblence between this cellulose and that of esparto, has led to the belief that paper thus made could be used for printing and for ordinary writing paper.

PLANTS YIELDING OILS, DYES, TANNINS, ETC.

324 – **Cultivation of Plants with Oleaginous Seeds in Holland.** — *Tijdschrift voor Economische Geographie*, Year X, No. 4, pp. 148-154. The Hague, 1919.

Even in 1669 there was a regular market for linseed oil at Amsterdam. In Holland, the cultivation of flax and other plants with oleaginous seeds had undergone, from 1851 to 1914, the changes indicated in the following table :

Area of crops yielding oil in Holland, from 1851 *to* 1914.

Plants	1851-1860	1861-1870	1871-1880	1881-1890	1891-1900	1901-1910	1913	1914
	hectares	hectares	hectares	hectares	hectares	hectares	hectares	hectares
Rape	28 658	23 117	12 690	7 635	4 701	3 047	1 193	1 654
Sunflower . . .	—	—	1 511	866	467	419	783	720
Flax	14 990	21 293	18 530	14 665	11 973	14 027	14 650	7 723
Hemp	1 556	1 460	1 412	389	173	67	30	30
Caraway . . .	—	—	—	2 301	3 380	5 394	5 527	5 285

This table shows that there was, generally, a decrease in these crops, with the exception of caraway ; but the latter is used as a condiment, and furnishes an essential oil.

This decrease in crops is due to the development of imports of exotic oleaginous raw material. In fact while there were, in 1878, only 5 steam oil-factories, there are now 50 steam factories and a total of 135.

RUBBER, GUM AND RESIN PLANTS

325 – **Precautions during Smoke Treatment of Rubber.** — VERNET, G. (Directeur du Laboratoire d'analyses de l'Institut Scientifique de l'Indochine), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, pp. 362-364. Saïgon, Dec., 1919.

Smoke treatment is excellent for the preparation of Hevea rubber (1) but the manner in which it is applied is fraught with serious danger of fire.

(1) The advantage of smoke treatment of rubber was much emphasised by M. FELIX RIPEAU a work published in 1914 bearing the title *Caoutchoucs* (*Hevea brasiliensis*) *ama-*

The following information aims at teaching planters how to avoid mishaps that might degenerate into disasters.

The heat developed by rubber on fire is such, that all efforts to extinguish it are useless and that the only thing that can be done is to isolate the outbreak.

The contrivances used at present for smoking rubber are more or less conceived in the same manner : — a fire-place outside with pipes leading the smoke to the room where the rubber sheets hang for treatment. If the size of the fire-place is adequate, it is easy to make the quantity of smoke required, by regulating the access of air and so engender incomplete combustion. Smoke is accompanied by soot and tar, which carried by a draught of hot gases, settle or are condensed inside the chimney and inside the pipes.

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zoniens et asiatiques, Étude comparative. Le traitment du latex. EMILE LAROSE édit., 11 rue Victor-Cousin, Paris.

In this work the author compares rubber grown in the Far East with that produced on the Amazon ; he indicates the reasons of the lower quality of the former and gives valuable information on improved systems of rubber growing and better handling of the latex.

It is to be noted first that the Heveas cultivated in the Far East are not the same variety or sub-species as those on the Upper Amazon famous for their product, Para-rubber.

Rubber trees of the Upper Amazon are the *Hevea brasiliensis* " preta ,, black, which yields the true black rubber.

The Heveas in the Far East came from the Lower Amazon, which even in their ordinary habitat yield a weaker latex after coagulation. The latex on the upper reaches of the Amazon yields 50-52 % dry rubber, but on the plantations it rarely is more than 25 %, a 30 days' average being 20 %.

On the lower course of the Amazon there are different varieties, which rubber planters call after some of the characters of the latex ; thus *Seringa branca* is the Hevea producing white latex, *Seringa iraca* the one with weak latex, *Seringa morada* yielding purple latex, *Seringa queimada* that with dark brown latex. The latex of all these varieties is more fluid, than that of the black Hevea.

According to the author the Heveas of plantations in the Far East are seedlings of the *Hevea morada* introduced in 1874, which is the best of the 4 above-mentioned varieties. It is not improbable that from seedlings of two imported varieties a third originated at some acclimatisation station in a British colony, c. e. *Hevea coniusa*, which became afterwards the variety predominant on Asiatic plantations.

The author believes that true black Hevea cannot be planted anywhere in Asiatic countries ; French Indo-China suits Hevea best, provided that it be planted in red soils of inland districts.

In order to obtain good rubber in the Far East, whatever the variety may be, tapping should never begin before the tree is 8 or 10 years old, not at 4 as it is now done. The tree should be allowed to rest : — 1) From the autumn till when the leaves are fully on again ; 2) during the height of the rainy season, because latex then is too thin. (On the subject of the age at which a tree may be tapped and on the extent of tapping operations, *See* précis of Girard's work in this *R.* January, 1920, No. 50). Further precautions are necessary see as follows : —

1) to adopt a method of tapping whereby the greater portion of the suitable bark may be utilised ;

2) to shorten the run of the latex to the cup ;

3) to avoid water getting into the latex by seeing to the basins used for latex collecting and by tracing the track for the latex flow not with water but with latex itself ;

It will be impossible for these to catch fire if the quantity of fuel to bank up in the fire-place is larger than that burnt with the draught raised. If on the contrary there is not enough fuel banked, or the draught is much too strong, the air rushes up the chimney and smoke pipes and carries with it the flames which ignite soot and tar. A fire thus starts like an ordinary chimney fire, the consequences of which may not be serious, if limited to the " stickage " of the nearest rubber sheets, but may have the most serious consequences, for the whole crop may be destroyed and the building with it.

Against such untoward occurrences a number of precautions may be taken:

(1) Sweep the chimney and scrape all smoke-carrying pipes, which

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4) to protect all vessels from air and dust;
5) latex handling should be done under conditions of utmost cleanliness;
6) to do away with acids for the coagulation of rubber;
7) not to employ rubber sheeting appliances before rubber has acquired body;
8) to dry rubber rapidly, by sun drying or drying in vacuum.

The author sees in the smoke treatment a good substitute for acids to assist coagulation. He obtained good results with carbon dioxide and creosote; creosote, being heavier, collects at the bottom and acts on the latex through its emanations; rubber is thus sterilised without any foreign substance remaining caught in it.

Smoke treatment: 1) does not hasten coagulation, but allows it to take place naturally, which is of the utmost importance; 2) sterilises rubber without leaving traces of foreign substances; 3) makes possible sun-drying, drying in vacuum or in special drying rooms. (According to the author, when acids are used as coagulants, it takes 2 or 3 months properly to effect drying in suitable places where sun-light is regulated; on the contrary 4 or 5 days of sun drying are sufficient in the case of rubber coagulated by the agency of smoke).

The system adopted by the "*seringueros*,, of the upper affluents of the Amazon, apart from being lengthy, cannot be applied to the latex of Hevea plantations, because this is much thinner.

The author conceived an excellent plan for the latex of *Hevea preta*. A drum arrangement takes the place of the other contrivance used by the *seringueros* for making the rubber ball, which is so hard and difficult to start. The drum is first smoked, then its cylindrical surface receives from 15 to 20 coats of latex; after smoke treatment rubber sheets are obtained in this way from about $^1/_6$ to $^1/_4$ inch thick according to market requirements. The drum after every 5 or 6 daubs should be rolled over a flat board in order to press the rubber on to the cylindrical surface; it will take rubber 10 minutes to harden and cool, after which the rubber sheet may be detached.

This method does not suit the thin latex of Heveas in the Far East. For this the author invented a special smoke treatment, which can be relied upon to give very good results. He gives a detailed description of the system and of the plant required. Briefly, these are the main points of the system:— 1) a layer of latex $^4/_5$ inch at most, is kept exposed to smoke in a closed room; the temperature of the room is lowered till the formation of a coagulum; this is washed, partially dried, drained under slight pressure and finally thoroughly dried; 2) the plant comprises a board on which can be placed many small basins all containing the aforesaid latex layer of $^4/_5$ inch; the board is placed in a cupboard of metal sheetings or in a room that can be well closed. Smoke from a stove is made to circulate round the room, round and over the basins containing the latex. Through special appliances smoke temperature can be regulated at will. (*Ed.*)

should consequently be so arranged as to make their frequent inspection easy.

(2) Unless great negligence be shown, it is easy to avoid the consequence of not having enough fuel banked up on the grate. For this it will be sufficient to adopt that system of banking the fuel in a box placed over the fire and in communication with the grate; from this box fuel automatically falls on the grate in the same proportion to that which is burnt. Fuel consumption is regulated by the amount of air admitted ; it is necessary to see that the fuel box never runs empty and that the grate is kept clean.

(3) Concerning fire prevention it is never superfluous to take all possible precautions even when these might look like a duplication of work.

If we trace the outbreak to the pipes, the simplest way to stop the fire is to stop the air, which is done by closing the 3 ends of the system. It happens, however, that when fire breaks out, nobody is about the place or the fire is noticed when it is too late for any action to be of real help.

Fire alarm devices are therefore necessary and the author describes one that could be easily made on the plantation. It is sufficient to place at intervals inside the pipes a sort of vertical trap very similar to a tiger trap and at the mouth of the stove or fire-place, a kind of mouse-trap as placed at the delivery end of the smoke driving pipes. These are all kept in position by a wire which runs through the pipes and over a pulley at the end. The wire is made of a metal with low melting point ; if fire starts up in the chimney or in any of the pipes, the temperature rises, the wire melts, the traps drop and close the system ; air being thus shut off, the fire stops.

It would be useful to put up several such arrangements through the whole system and, whatever the device adopted may be, care should be taken to keep it in working order by preventing an accumulation of soot and tar on the gear. The safety wires commanding the traps should be of tin, lead or zinc the melting points of which are 439°, 635°, and 743° F respectively.

(4) At any time, through unsatisfactory working, the device might not prevent the leaping flames from reaching the delivery end of the pipes inside the drying room ; against such possibility it would be wise not to hang the rubber sheets too close to them and so avoid " stickage ".

SUGAR CROP

326 – **The " Uba " Variety of Sugar Cane in British South Africa.** — *Tropical Life*, Vol. XV No. 10, pp 154-155. London, Oct., 1919.

In 1897, Zululand was annexed by England and became part of Natal its area is about 10 500 sq. miles and its population, according to the Census of 1904, consisted of 1693 Europeans, 203 373 natives and 120 Indians After the publication of the Zululand Commission's report in 1905, agricultural settlement made rapid progress; for this the sugar industry is solely responsible and the " Uba " variety of sugar-cane has largely contributed to the progress made.

Although the sugar-cane is a tropical plant requiring great heat and an abundant rainfall, it can be successfully grown in a sub-tropical climate, as is proved by the plantations in the coastal belt of Natal, a region extending from Port Shepstone (on the south coast) to beyond the Umfolosi River (on the north coast), and measuring about 260 miles in length.

The average mean temperature of this sugar-cane region in Natal is 77°F. and the superior results obtained in Zululand are attributable to the higher mean temperature prevailing in that northern area, where the period necessary for the maturing of the cane is, consequently, shorter.

As sugar-cane does not mature in one year and has to face extremes of climate, severe losses are common; thus, the "Uba" variety of cane is extremely interesting because of its great resistance to local adverse conditions. The average annual rainfall is a little under 40 inches, but this limited rainfall is in some measure compensated for, by heavy rainfall precisely at the period of vigorous growth of the cane, by a comparatively humid climate and by judicious manuring.

It is said locally that the name "Uba" or "Yuba" is derived from the only letters legible on the label attached to this variety when first brought into the colony. The origin of this variety is uncertain: some say that it originated in Brazil, others that it originated in India and was introduced into Brazil.

Mr Pearson gives the following analysis of the juice of the "Uba" sugar-cane:—

	Average	Maximum
Total solids	20.32 %	22.79 %
Sucrose	18.61 %	20.79 %
Purity	91.60	91.20

Though there is a large proportion of fibre in the cane, this indicates no inferiority in the juice; in fact the quality of the juice is not surpassed by any other variety, as is shown by the results of analyses made of 33 other varieties (chiefly Hawaiian and Demeraran).

In conclusion the utility of nitrogenous fertilisers in conjunction with phosphatic and potassic fertilisers in the Hawaiian islands is referred to, and the method of cultivation practiced in those islands is described (1).

(1) The work by M. Léon Colson entitled *Culture et Industrie de la canne à sucre aux îles Hawaï et à la Réunion*, 1 Vol., 431 p., 1905, Challamel Édit., 17 rue Jacob, Paris, may here be referred to: the question of fertilisers for sugar-cane cultivation in the Hawaiian islands is dealt with on pp. 32-34. (*Ed.*)

327 - **Experiments Made in India Regarding: I. The Method of Planting Sugar-cane Setts; III. The Effect on the Yield of Various Plants of the Position of the Seeds in the Soil at the Time of Sowing.** — KULKARNI, M. I., (Acting Deputy Director of Agriculture, Southern Division, Bombay Presidency), in *The Agricultural Journal of India*, Vol. XIV, Part 5, pp. 791-796, 2 fig. + 5 pl Calcutta and London, Oct., 1919.

I. — Results of experiments comparing the method of planting sugar-cane setts of one eye-bud placed upwards with other improved methods, especially with the method of setts of 3 eye-buds pointed sideways.

Owing to special conditions of soil and water the Brix reading of the juice scarcely exceeded 14 % in the different methods of cultivation. Hence the Table given below (which compared the results given respectively by: — (*A*) Setts of one eye-bud pointed upwards; (*B*) setts of three eye-buds pointed sideways) indicates only the yield in cane and not the yield of "gur" (crude sugar).

Results of comparative experiments of plantation.

Method of planting	Number of eyes planted	No. of plants germinated after 20 days of planting	Percentage of germination	No. of plants finally Kept (mother and tiller plants)	Number of canes harvested	Weight of canes harvested	Average weight of one cane
						lb.	lb.
I. — Plot of 1 "guntha" (1/40th of an acre):							
A) Single eye-bud, point upwards	901	833	82	1 079	843	4325	—
B) Three eye-buds, points sideways	1 002	511	50	889	782	3366	—
II. — Plot of 30 "gunthas" (3/4 *of an acre*)							
A) Single eye-bud, point upwards	27 030	24 990	82	32 370	25 290	129750	5.1
B) Three eye-buds, points sidewais	30 060	15 330	50	26 670	23 460	100980	4.3

The Brix reading being only 14.2 % in both methods of planting, the yield in "gur" obtained for 30 *gunthas* was: —

(*A*) Single eye-bud, point upwards . . . . . 12 570 lb.
(*B*) Three eye-buds, points sideways . . . . . 9 660 »

If the Brix reading had been 18 to 19 %, as is usually the case for sugar-cane, the yield in "jur" would have been: —

(*A*) Single eye-bud, point upwards. . . . . 16 350 lbs
(*B*) Three eye-buds, points sideways. . . . . 12 725 »

These figures show that the yield of cane was about 25 % higher with method (A) than with method (B). Further experiments on a larger scale are being carried out on the Canal Farm at Gokak.

There are, however, certain disadvantages in the method of planting single eye-buds, point upwards. The setts being too small and exposed on both sides close to the bud, the plants developed from them, though they take more quickly than those developed from setts with 3 eye-buds, points sideways, look somewhat unhealthy during the first month until a small dose of ammonium sulphate is given as a top-dressing ; but after that top-dressing the plants (A) grow as luxuriantly as plants (B).

The following year a fresh experiment was made: — Setts with 3 eye-buds were taken and the middle eye-bud was removed; the sett was then planted with the two remaining eye-buds upwards. It is expected in this way to obtain a better yield than with the single eye-bud point upwards method of the previous year, owing to the elimination of the defects of the single eye-bud method while retaining the advantage of position of the eye-buds point upwards.

II. In view of these results, the author investigated the effect which the position of the seed in the soil at the time of sowing might have on the yield of various plants.

Experiments with maize, leguminous plants and cotton showed that when the seed is planted with the point downwards or sideways, the resulting plants are better than when the seed is planted point upwards.

The position of the seed in the soil at the time of sowing is one of the numerous causes of the unevenness in plants and crops, and even of the non-germination of good seed. But in practice it is only possible to plant the seeds in the proper position when planting is done by hand.

328 – **Prevention of Soil Erosion on Tea Plantations in Southern India.** — ANSTEAD, R. D. in *The Agricultural Journal of India*, Vol. XIV, Part 5, pp. 787-790. Calcutta and London, Oct., 1919.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

At the meeting of the Board of Agriculture in India, held at Pusa in 1916, the subject of soil erosion was discussed and it was resolved to bring to the notice of planters the fact that the serious losses hitherto due to this erosion are to a large extent preventable.

Dr. HOPE, of the Indian Tea Association, has published an interesting account of the terrace methods adopted in Java, to prevent loss of valuable top soil in the tea districts. This te racing, however, was done before the plantations were made. The problem presented on many tea estates in the South of India is, on the other hand, to stop soil erosion on old established plantations, and a good deal of work has been done in several districts during the last few years with the object of solving this problem in a practical and economic manner. Two methods have been adopted with success. The first is a modification of the terracing done in Java. At the time of pruning, trenches are opened along the contours of the slopes at intervals of 4 or 5 rows of tea bushes. These trenches are from 18 to 24 inches deep and are filled with the tea prunings the upper layer of prunings being packed so that the butts project 6 to 8 inches from the ground level, when the trench is filled, and thus form a low fence. The soil in the intervening rows of tea bushes is then forked and manured, if

necessary ; and in some cases a green manure crop is sown on it. The low fence of buried prunings serves to catch any soil washed down. Unfortunately, the tea bushes have generally been planted not along the contours but along the line of steepest slope. It is, however, possible to work along the contours and gradually arrive at the formation of terraces where the prunings have been buried. At the next pruning season the terraces are improved and new ones made in the same way. This method has been found to work excellently on moderately steep slopes where it is already much used.

The second method used is to abandon forking and clean weeding (1) on steep slopes and to keep the soil covered with suitable weeds. This method, of course, meets with opposition from planters of the clean-weeding school, but in Southern India the fetish of clean weeding is becoming obsolete. The proposed method has the defect, in dry seasons, of depriving the tea bushes of part of the moisture of the soil and the tea may suffer, but this defect cannot compare with the harm done by the erosion of bare soil. The choice of plants to be used for covering the soil is very important. Ideal plants are leguminosae, as they will fix nitrogen and neither climb into the tea bushes, nor form too thick a mat on the ground, and do not grow more than a few inches high. Such a plant is difficult to find, and the plant which seems to come nearest to the ideal is *Cassia mimosoides* L. a leguminous plant which, at altitudes of 4000 feet and over, keeps low and spreading ; it allows the rain and sun to reach the soil while protecting it from erosion ; it is easily established and seeds freely.

Another leguminous weed experimented with is *Parochetus communis* Hamil., a plant with a clover-like habit, but it is not easy to establish over large areas for its life is not long and it dies down to the creeping rhizome in the hot weather.

When a suitable leguminous plant cannot be found other weeds can be used, among which may be mentioned *Oxalis corniculata* L., *Cotula australis* Hork., *Cardamine hirsuta* L., *Galinsoga parviflora* Cav., and *Laurembergia* (*Serpicula*) *hirsuta* W. and A.

329 – **Possibilities of Tobacco Cultivation in British India.** — *The Wealth of India* Vol. VIII, No. 9, p. 422. Madras, Sept., 1919.

Dealing with the future possibilities of tobacco cultivation in India, specially as regards the raising of new varieties, the Director of Agriculture at Hyderabad states that India is situated more favourably than European States where foreign varieties of tobacco have been acclimatised. In Europe the climate is such as not to allow of the full attainment of the aroma which the introduced varieties possess in their country of origin but Cuban tobacco has been successfully grown in Austria with remarkably good aroma, and there is no reason why foreign tobacco should not be grown and retain its original qualities (if manuring and curing are properly

(1) Regarding, clean weeding see *R.*, Febr. 1919, No. 205, III, where this method is described with reference to Hevea plantations in Indo-China. (*Ed.*)

attended to) in such a vast country as India where it should not be difficult to find a soil and climate suitable for its acclimatising. As in the case of peanuts and other crops, India should produce excellent tobacco and might become the chief tobacco supplying country in the world.

330 – **Experiments in Tobacco Growing in Cambodia** (1). — DELOCHE DE CAMPOCASSO, (Chef p. i. des Services agricoles et commerciaux an Cambodge) and MERCKEL (Chef de la Station séricicole, d'élevage et d'hydraulique agricole du Petit Takéo) in *Bulletin économique de l'Indochine*, Year XV, New Series, No. 238, pp. 781-782. Hanoï-Haïphong, Sept.-Oct., 1919.

The experiments were carried out at the agricultural station of Petit Takéo, near Phnom-penh, with varieties supplied by the Tonkin Tobacco Factory and with a native variety.

These trials were made in a year of extraordinary drought and in strong clay soil; plants therefore suffered from climatic adversity and, notwithstanding that, however, vegetation was generally good. The varieties were 1) Comstock, 2) Maryland, 3) Hungary, and 4) Khmer (Cambodia variety).

1) *Comstock.* — The best of the 4 varieties tried from the point of view of growth, size of leaves, aroma and combustibility. The aroma is not too strong and the colour of the leaves is much darker than that of the other three. It was the least affected by insect pests. The crop of leaves, after curing, was 670 kg. per hectare.

2) *Maryland.* — The least satisfactory growth and appearance of leaves, which are much smaller, wrinkled, and subject to attacks from insects; crop 326 kg. per hectare.

3) *Hungary.* — Good variety, satisfactory growth, leaves lighter in colour than those already mentioned; little attacked by insects. Very much like the variety Khmer in appearance, so much so that even experts may easily take one for the other. Crop 854 kg. per hectare.

As cigarette tobacco it burns well, leaving a white ash; the smoke is not acrid, the aroma is light and agreeable.

4) *Khmer.* — This is the common variety of the country, very good from the point of view of vegetation. Beautiful leaves, crop 1000 kg. per hectare. It is the largest yielder. Tolerably good as cigarette tobacco, the aroma is rather peculiar and many do not like it.

The author remarks that the variety Hungary has all the hardiness of Cambodian Khmer and has, moreover, aroma, combustibility and sweetness; it would be worth while to continue the experiments and for the present, limit the trial to this variety.

331 – **Cinchona and Rainfall in Indo-China.** — VERNET, G., in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, p. 380. Saïgon, Dec. 1919.

The *Bulletin pluviométrique* for the year 1918, published by M. G. LE CADET, Director of the Central Observatory of Indo-China, contains

(1) See *R.*, Jan., 1919, No. 61. *Tobacco Growing in Indo-China.* (*Ed.*)

valuable information regarding the agricultural possibilities of the colony, as the rainfall chart inserted at the end of the pamphet gives a general idea of the distribution of rainfall throughout Indo-China.

The comparison of this document with the report of M. CAPUS, entitled " The Possibilities of the Cultivation of Cinchona in Indo-China ", reproduced in this *Review* (1), will give an idea, based on actual observation, of the regions which are worth studying, especially as regards cultivation of cinchona. It is thus noted that the portions of the area where rainfall exceeds the annual 2500 mm. are very extensive in all the mountainous regions, and those which exceed 3000 mm. are not rare in Indo-China, that is to say in regions whose altitude does not correspond to too marked a decrease in temperature.

The cultivation of cinchona need not be limited to the highest regions of the Indo-Chinese mountains, for the average latitude of the colony is very different to that of India or Java (2). The high valleys and plateaux whose altitude does not exceed 1000 m. ought to be specially investigated with this object.

ARBORICULTURE

332 - **Progression of Ripening of " Knife " Pears.** — RIVIÈRE, G. and BAILHACHE, G., in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, Vol. XX, pp. 306-307. Paris, Dec. 1919.

Experiments by the authors on pears of the varieties Beurré Hardy, Duchesse d'Angoulème, and Doyenné du Comice, which have enabled them to determine that ripening of " knife " pears shows itself first in the tissues near the peduncle, and that it progresses gradually up to the eye, but with greater or less rapidity according to the variety.

The analytical results obtained are shown in the following table: —

Progression of ripening of pears.

	Percentages of sugar in the pulp		
	Beurré Hardy	Duchesse d'Angoulème *	Doyenné du Comice
1) Part near the peduncle . . .	8.91 %	12.31 %	10.78 %
2) Central part	7.98	12.10	10.72
3) Part near the eye	7.90	12.12	10.62

* At the time of the analyses the Duchesse was the ripest of the pears.

VITICULTURE

333 - **Viticulture in the State of Victoria, Australia.** — *Queensland Agricultural Journal*, Vol. XII, No. 4, pp. 186-187 and No. 5, pp. 246-247. Brisbane, Oct. and Nov., 1919.

The United Kingdom imports large quantities of fresh grapes from Spain. The export of fresh grapes from Spain starts every year in July and lasts till December. The largest consignments are made in the winter months ; the quantity shipped to the British Isles and other European

(1) See *R.*, Jan., 1920, No. 55. (*Ed.*)

(2) For " The Cultivation of Cinchona in Java " see original article by Dr. J. VAN BREDA DE HAAN in *R.*, Nov., 1915. (*Ed.*).

countries and to North America is about 57 000 tons. From this figure may be gathered the importance commercially. The variety is the " Ohanez ", better known by British merchants by the name of Almería, because Almería is the port of shipment.

Grape-growing on a large scale has good prospects in Australia. There is, in fact, a large local demand for fresh grapes and the vine is also cultivated for raisins and wine ; but the best possibilities in front of Australian viticulture lie in the export trade. In fact, from its geographical position Australia can supply the United Kingdom when there are no other grapes on the market ; Australia would do well by shipping grapes, when none are being sent from Spain, and this would be just about the end of winter.

The " Ohanez " variety is most suited to Australia, particularly to the northern districts of Victoria, where the atmosphere is drier than in the Spanish province of Almería ; there the character of this grape would show to advantage. It is a choice variety, heavy bearer, tough skinned, very much appreciated on local and foreign markets. These grapes are of excellent quality and are the best for export ; they travel well and arrive in quite good condition on the overseas markets.

A trial shipment proved a most successful venture ; Ohanez from Victoria fetched in England a higher price in summer than did Spanish grapes in winter. The net return per acre was very handsome.

To grow " Ohanez " successfully, fairly good soil is required and water should be available for irrigation purposes. Easy access to the railway is also needed.

An important company, the " Australian Farms Ltd. " (King St., Melbourne), is doing much for the development of the Victorian grape industry. This company has secured some very good land for the purpose on the shores of Lake Kangaroo. It can be irrigated and is near a railway station. The company offers good terms to intending vine growers and assistance in various ways.

LIVE STOCK AND BREEDING

334 – **The " Lucacha " *(Latrodectus mactans)*, a Small Peruvian Spider whose Bite is Poisonous to Man and Animals.** — ESCAMELS, ED., in *Bulletin de la Société de Pathologie exotique*, Year XII, No. 9, pp. 702-720, 1 fig. Paris, Nov. 12, 1919. HYGIENE

Study made in Peru by the author, on the " lucacha ", a small black spider with red spots, identified as *Latrodectus mactans* Fabr., which adapts itself to all climates in the world, tropical as well as the very cold climates of the high plateaux of the Peruvian Sierra. This spider is poisonous but, according to the author, the effects of its bite have been attributed to the bite of other animals (a scorpion, *Brachytosternus ehrenbergi* ; an inoffensive lizard, *Phyllodactylus gerrhopigus*).

CONCLUSIONS. — 1) The *Latrodectus mactans* has lived in the north and south of Peru from time immemorial. At Arequipa the investigations of the author have brought it to notice for the first time.

2) This spider lives between the stones or small plants in the country ; it is most numerous in the zone between cultivated and uncultivated regions.

3) The *Latrodectus*, commonly called " lucacha ", sometimes comes into crops of wheat and alfalfa, constituting a danger for the country people when harvesting, or the animals which feed there.

4) Its bite produces in man and animals the neuro-myopathic *lactrodectism* or *arachnidism* of SOMMER and GRECO.

5) Inoculation of animals with the eggs of the spider produces, according to the dose, either neuro-myopathic arachnidism or else cutaneous hæmolytic-gangrenous arachnidism.

6) Intraperitonial mass injection is rapidly fatal.

7) Repeated bites gave a certain immunity to animals used in the experiment.

8) Fractional injections of eggs did not produced immunity, for, sooner or later, as soon as the toxic dose was slightly exceeded, the animal died.

9) The venom of the " lucacha " can be considered as a *cerebro-neuro-muscular* poison, a *thrombokinase*, a *hæmolysin*, and in the eggs a *proteolysin* in addition.

10) The venom, the eggs of the cocoons, the eggs of the abdomen of the females, and the young spiders recently hatched give venomous and hæmolytic extracts in progressively decreasing order.

11) Diagnosis is generally fairly easy to make.

12) Prognosis is variable, both owing to the effect of the venom itself, and owing to superadded secondary infections.

13) Internal and external treatment with permanganate of potash, promptly and thoroughly used, is a certain cure.

14) This remedy should always be in readiness with the country-people. It should also always be found in the outfit of the explorer.

335 – **Prophylactic Inoculation of Cattle Against Foot and Mouth Disease.** — LUTRARIO (Director General of Public Health in Italy), in *Office International d'Hygiène publique, Bulletin mensuel*, Vol. XI, Part 3, pp. 266-272. Paris, March. 1919.

The problem of immunising cattle against epizootic foot and mouth disease has always been the object of keen attention of the Department of Public Health in Italy. That Department began by making practical use of all that was generally known of the pathogenesis of epizootic foot and mouth disease in relation to immunity.

It is known that an attack of foot and mouth disease naturally or artificially caused is immediately followed by a state of immunity of longer or shorter duration. Consequently, cattle for slaughter shipped by sea from an infected area, and thus with the disease in incubation, are first inoculated at the port of embarkation ; as soon as they are well they are disinfected and shipped, with the certainty that they will not develop the disease on the journey. The advantages of this method were proved by the inoculation carried out at Salonica in 1911 on Serbian cattle

imported into Italy, by those made at Naples and Castellammare on cattle sent to Libya in 1915, etc. ; however this application does not constitute a sure method from which great results can be expected in the prophylaxis of epizootic foot and month disease. For this reason the Department of Public Health has relied on wide research in the matter of immunity against epizootic foot and mouth disease.

In 1914 work was commenced entrusted to a special Committee which after became a ministerial Commission consisting of (1) Professor Alfonso Di Vestea, of Pisa University, President. (2) Professor Achille Sclavo, of Siena University. (3) Professor Alessandro Lanfranchi, of Bologna University. (4) Professor Camillo Terni, Co-Director of the Experimental Station for infectious cattle diseases at Milan. (5) Professor Mori, Director of the Experimental Station for infectious cattle diseases at Portici. (6) Dr. Angelo Parodi Delfino, of Reggio Emilia. (7) Dr. Carlo Bisanti, Veterinary Inspector General. (8) Dr. Giuseppe Cosco, Veterinary Inspector General. (9) Professor Alfredo Bartolucci, Provincial Veterinary Surgeon attached to the Department of Public Health, Secretary.

Each experimentor uses the well-equipped laboratories of the various Experimental Stations for infectious cattle diseases. Thus, those working in northern Italy use the Milan Station ; those working in southern Italy have at their disposal, for want of an Experimental Station, a laboratory specially created at the Royal " Cascina " (Farm) of Poggio near Florence.

The following is a short account of the results obtained during the first 3 years of the research :—

I. — *Immunising method suggested by Professor* Terni. — This consists in strengthening and prolonging, by successive inoculations of virus specially prepared and graded, the immunity which the animals have already acquired in consequence of a first attack, natural or artificial, of the disease.

Under these conditions, inoculations with the virus cause a reaction fever without any internal symptoms of the disease and in this way generally, after 3 inoculations, super-immunity is assured against natural infection which lasts during the whole dairy period for milch cows. It is, in short, a method of vaccination with natural virus which is applied to young animals at an age at which initial infection does not cause sensible harm and when infection is easily dominated and which is continued to such a point that a degree of immunity is obtained guaranteeing the animals against all further natural infection.

This method has been frequently tested in practice; not only have the animals vaccinated been exposed with impunity to natural infection in fields and cowsheds, but quite recently, an outbreak of the disease having occurred in an experimental cowshed in the Milan district, a Station under Professor Terni himself, the vaccinated animals were all ill, to such an extent, that the farmers asked for the practical application of the method on a large scale. From experiments made up to date the following doses may be considered effective :—

(A) Intravenous inoculation. — First inoculation of 25 to 50 cc. of hysuper-immunised blood (blood taken from oxen saturated with aphthous virus) according as the animal is young or full-grown. Second inoculation 4 or 5 days later as above with the addition of 25 cc. of a solution containing 1 % of filtered virus or 50 cubic cm. of blood of fixed virulence. Third inoculation 8 to 10 days after the second.

(B) Subcutaneous inoculation. — Same inoculation as in the previous case only doubling the dose of hyper-immunised blood.

PRINCIPAL THEORIES RESULTING FROM PROFESSOR TERNI'S WORK ON THE PATHOGENESIS AND EPIDEMIOLOGY OF EPIZOOTIC FOOT AND MOUTH DISEASE. — (1) The best and surest channel of inoculation is by the digestive organs; the penetration of the virus by other natural channels (either by the skin or by the teats) is always slower and does not cause the appearance of the general symptoms before virus is present in the rumen, the favourite seat of incubation of the virus itself.

(2) The local aphthous lesions are always the first to appear and they are noted as initial even before the fever ; by rumination the virulent matter in incubation in the rumen which spreads over the mouth infects locally the epithelial abrasions.

(3) Next appear the aphthae in the hind feet, following infection communicated by the dung which may remain unmoved for several days in the lower part of the intestines, especially if the animal is on dry fodder. The aphthae in the fore feet develop as a consequence of pollution caused by passing over contaminated litter or by the laver from the mouth of the animal. The evidence from protecting of the feet before infection is in favour of this criterion.

(4) The aphthae on the teats originate from local inoculation; the virus, present in the milk when the infection becomes general, collects round the entrance to the lactiferous canal, but at other points the aphthae are caused by inoculation by milkers who habitually lubricate the teats with the milk itself. When not milking, the aphthae on the teats are due to insect bites, dirty litter, movements of the animal's tail, etc. Careful disinfection of the teats and the hands of the milkmen and the use of antiseptic lubricants reduce the aphthous eruption on the teats to a minimum.

(5) As soon as fever shows, the blood becomes infectious for a short period, but always to a less extent than the liquids in the digestive channels.

(6) Still more important than the injuries observed in the stomachs and in the œsophagus, represented by epithelial abrasions and localised ulcers, in severe and fatal cases of foot and mouth disease, are the injuries to the small intestine especially in the duodenum and the first part of the ileum. The intestinal lesions of foot and mouth disease correspond in their histological characters, with those produced experimentally on animals by vaccine inoculated internally and with intestinal lesions of small pox in man. These intestinal lesions are very frequent and are the cause of late manifestations of infection reducing by about one half the economic yield of the animal. The absorption of aphthous virus in fatal cases de-

pends on special conditions of the digestive tube, and these conditions depend in turn on excessive bulky food.

(7) The so-called re-infections at short intervals are only relapses depending, generally, on disorders of the digestive organs. Bacterial fermentation in some cases, renders the first attack of the disease abortive and hinders the production of a state of immunity, thus giving rise to true re-infections; however, a natural immunity to the disease exists and lasts for about 8 months.

Results obtained in the experimental cowshed of Poggio at Caiano (Florence). — On other lines than that followed by Professor Ferni, the experimentors of the Commission are at present engaged on attempts to find a practical method of immunisation against foot and mouth disease.

In the experimental cowshed of Poggio at Caiano (Florence), to which is attached a laboratory furnished with all necessary apparatus, a Station under Dr. Cosco, Veterinary Inspector General, assisted by Dr. Aguzzi, Provincial Veterinary Surgeon of Florence, facts of considerable importance have been ascertained.

It has been possible to obtain precise evidence of the characteristic properties of the blood of animals suffering from the disease with regard to the virulence of the serum and of the red globules. These properties of the blood of aphthous animals (unknown or obscure previously) may be summarised as follows :—

The blood of aphthous animals is virulent during the whole period of fever.

The red globules and the serum of the blood of animals attacked are virulent.

The red globules after many washings in large quantities of sterile physiological solution to eliminate all trace of serum, cause infection by subcutaneous inoculation of cattle even with a dose of 1 cc.

Further research has in addition established the following :—

(1) Intro-venous injection of virulent blood corpuscles (obtained from producing animals after a series of passages until a severe clinical form is present, and after a minimum period of incubation of about 70 hours) does not cause the disease unless a certain dose is exceeded, which, in the case of the animals used in the experiments (of various breeds, aged from 12 to 18 months), is about 30 cc.

(2) An excellent dose for use in the first treatment of cattle is 25 cc.; in the second treatment it may be raised to 30 cc. cm., and in the third treatment even to 45 cc.

(3) The vaccination is followed by the typical reaction represented by a rise in temperature showing itself 1 or 2 hours after the injection and rarely later. This reaction lasts several hours (8 to 10 hours and sometimes longer) and is repeated on the following days in a less degree for several successive days (2nd, 3rd reaction). This thermal reaction is accompanied by generally very slight discomfort (flatulence, horripilation, muscular trembling) sometimes scarcely noticeable and, occasionally;

even non-existent. Generally, the thermal reaction is less marked in the 2nd treatment and is often insignificant in the 3rd.

(4) A period of 10 days should elapse between the treatments. A shorter interval may cause, at least in certain cases, a development of the disease after the 2nd treatment.

(5) Two animals which had never had foot and mouth disease, given 3 treatments according to the method indicated above, and exposed 4 months later to infection in a cowshed where there were cattle suffering severely from foot and mouth disease caused by natural infection, showed absolute resistance, while control animals were attacked in 48 hours by a severe form of the disease.

336 – **The Common Human Flea as a Parasite of Pigs in the Argentine.** — BRETHÈS, J., in *Anales de la Sociedad rural Argentina*, Vol. LIII, No. 10, pp. 443-444, 1 fig., Buenos-Ayres, July, 1919.

In the piggeries of the south and western parts of the province of Buenos-Aires, several examples of *Pulex irritans* have been found. This flea, which hitherto has only been found on men, dogs and cats, is very abundant in the Argentine on pigs, and particularly, on sucking-pigs. The eggs are found in the litter.

From an examination of the scientific literature on the subject it appears that hitherto only one other kind of flea, *Dermatophilus penetrans*, has been found on pigs.

To exterminate these parasites the author advises the construction of cement piggeries, which should be kept very clean.

337 – **Aspergillosis of Poultry.** — HITIER, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 37, pp. 951-952. Paris, Dec., 3 1919.

M. HITIER presents to the Accademy a report by M. LE COMTE DELAMARRE DE MONCHAUX on aspergillosis of poultry in which the author sums up a communication made by him to the Avicultural Section of the Société des Agriculteurs de France.

This mycosis, regarding which there is scarcely any mention in avicultural treatises, has been noticed in a great number of species: — geese, turkeys, swans, ducks, chickens, pigeons, etc. Man himself is not exempt, as is proved by the pseudo-tuberculosis of pigeon feeders, studied by RÉNON.

The *Aspergillus fumigatus* responsible for this disease, named in 1863 by FRESENIUS, had already been described and illustrated in colour by DESLONGCHAMPS in 1841.

Very common in nature in a saprophytic state, it gives rise, according to the author (under the influence of causes still little known, for example of a wound which gives them entrance into the organism and circulation), to pathogenic strains which develop in the bird with a great power of growth and cause an infection the results of which are generally fatal.

The object of the author has been specially to draw the attention of breeders to a disease which is often unperceived and for which the right remedy has yet to be found.

338 – **The Use of Naphthalene as a Remedy Against Chicken Lice.** — ABBOTT, W. S., in *Journal of Economic Entomology*, Vol. XII, No. 5, pp. 397-402. Concord, N. H., Oct. 1919.

The author has experimented with various preparations of naphthalene as a means of destroying chicken lice of the species *Menopon biseriatum*, *M. pallidum*, *Lipeurus heterographus* and *Goniocotes abdominalis*. The naphthalene used for dusting in the feathers a powder containing 5 % of naphthalene is ineffective, but a powder containing 10 % is very effective; it causes, it is true, slight discomfort but this is quite temporary and after 5 to 10 minutes the fowl no longer feels any ill effects.

By thoroughly rubbing powder containing 60 to 100 % of naphthalene into the feathers there is risk of killing the fowls; on the other hand, powders of the same strength lightly dusted over the feathers cause no permanent injury.

A suitable method for reducing considerably the number of lice consists in sprinkling finely powdered naphthalene over the fowls when they are roosting at night; but this method requires further testing.

Balls of naphthalene placed in the nest had no effect in diminishing the number of lice on the hen setting or laying there, but they injured the hens and prevented them from setting well and seemed to have a toxic effect on the eggs and newly hatched chicks.

339 – **Eradication of the Depluming Mite of Chickens by One Treatment.** — WOOD, H. P. in *Journal of Economic Entomology*, Vol. XII, No. 5, pp. 402-404. Concord, N. H., Oct. 1919.

The author has reported that the depluming mite of chickens (*Cnemidocoptes gallinae*) can be completely eradicated by a single treatment of one of the following: =

Lime-sulphur bath: 1 pound of lime + 2 pounds of sulphur + 1 gallon of water; dilute the mixture in 20 parts of water.

Tobacco sulphur bath: 3 teaspoonfulls of " Black leaf 40 " tobacco extract + 6 ounces of sulphur + 2 ½ gallons of water.

Arsenical bath as used for destroying ticks in cattle.

Sodium fluoride and sulphur bath: ¼ ounce of sodium fluoride + 2 ounces sulphur + 1 gallon of water.

Sodium fluoride, sulphur and soap bath: ¼ ounce of sodium fluoride + 2 ounces sulphur + sufficient soap to make the water soapy + 1 gallon of water. This bath destroys not only the depluming mite but also lice.

Kerosene emulsion is effective against the parasite but is injurious to the fowl treated.

340 – **Glutinated Maize Bran.** — CONSOLANI, G., in *Il Coltivatore*, Year LXVI, No. 1, pp. 10-12. Casale Monferrato, Jan. 10, 1920.

FEEDS AND FEEDING

Glutinated maize bran is that which remains of the grain after the starch has been extracted from it, and compared with maize, a food with a more narrow that is to say concentrated, nutritive ratio.

After having been hulled by means of brush cleaners, the maize is put to soak in vats containing water at 45° to 50° C. in which sulphurous anhydride has been stirred. After soaking for 3 days the maize is crushed

in special mills, and passed under a continuous jet of water into cement basins where it undergoes a second soaking. Then it is passed into extractors, through which the starch flows in the form of milk and is separated from the residues of the grain. These pass into a second mill where they are re-ground, then into a second extractor, where they undergo the same process as in the first. Thus the bran is separated, which contains already a little gluten, and which is pressed in hydraulic presses, then dried.

The starch, separated by the extractors in the form of milk, is led into vats, furnished at the bottom with several tubes, each of which is above a hair sieve of very close mesh. The glutinous part of the maize, which was mixed with the starch, remains in these sieves, after which it is passed into other special sieves, where it undergoes a washing under a continuous jet of water, with the object of allowing any remaining starch to pass. Finally the gluten is pressed in filter-presses, dried, and mixed with the bran previously separated.

Whole maize, maize bran and glutinated maize bran (analyses made by the Agricultural Station of Modena of a sample prepared at the starch factory at Massa Superiore, Rovigo) have respectively the percentage composition shown in the following table: —

	Grains of maize	Maize Bran	Glutinated maize bran
Water	13.00 %	13.20 %	9 40 %
Pr tein	9.88 »	14.10 »	23.99 »
Digestible albumen	6.6 »	9.8 »	18.6 »
Nitrogenous-free extracts	69.24 »	56.00 »	47.37 »
Fat	1.40 »	3 70 »	13.05 »
Ash	1.30 »	5.80 »	1.36 »
Cellulose	2.18 »	7.20 »	4.83 »
Nutritive ratio	9.44 : 1	4.6 : 1	3.7 : 1
Commercial units	93.70	83.57	about 130

Glutinated maize bran constitutes, therefore, an excellent food, which should be widely used. Feeding tests with this product have always given good results. It is suitable chiefly for the fattening of cattle and pigs, for the feeding of milch cows, young animals in general, and poultry. It is fed in quantities of about 1 kg. per day to calves, 2.5 to 3 kg. to large cattle, and 0.5 to 1 kg. to pigs. As it is a very dry food, it should be moistened with water, salt for preference, so as to form a mash. It is an excellent ingredient for porridge.

The sale price of glutinated maize bran being less than that of ordinary wheat bran, it is, therefore, one of the most suitable concentrates from an economic standpoint.

HORSES

341 – **Feeding Work-Horses in the United States.** — Bell, G. A., and Williams, J. O. in *Farmer's Bulletin* 1030, U. S. Department of Agriculture, pp. 1-24. Washington Dec., 1919.

The authors state that the selection of the most suitable rations for working horses is governed largely by local conditions, and they dea

TABLE I. — *Maintenance ration for idle horses, per* 1000 *pounds of live weight.*

(Theoretical daily requirement 0.60 pounds of protein and 7.30 therms of energy).

Ration	Protein (*Pounds*)	Energy (*Therms*)
5 pounds ears of maize	0.280	3.420
3 » alfalfa hay	0.213	1.0269
9 » maize stalks	0.144	2.8458
	0.637	7.2927
4 pounds oats	0.348	2.7024
4 » clover hay	0.196	1.5472
10 » oat straw	0.08	3.481
	0.624	7.7306
8 pounds alfalfa	0.568	2.7384
8 » oat straw	0.064	2.7848
3 » cane malasses	—	1.6614
	0.632	7.1846
5 pounds cowpea hay (*Vigna Catjang*)	0.460	1.8795
5 » maize silage	0.030	0.7950
10 » timothy hay	0.220	4.3020
	0.710	6.9765
4 pounds rolled barley	0.332	3.5976
4 » alfalfa hay	0.284	1.3692
7 » barley straw	0.042	2.5627
	0.658	7.5295
4 pounds alfalfa hay	0.284	1.3692
14 » maize stalks with ears	0.322	6.1516
	0.606	7.5208
2 pounds maize grain	0.140	1.710
4 » oat hay	0.156	1.290
10 » hay	0.330	4.493
	0.626	7.493
3.5 pounds maize grain	0.245	2.9925
3 » cowpea hay	0.276	1.127
10 » oat straw	0.080	3.481
	0.601	7.6005

TABLE II. — *Ration for horses, very light work, per* 1000 *pounds live weight.*

(Theoretical requirement, 1 pound protein and 9.80 therms energy).

Ration	Protein (*Pounds*)	Energy (*Therms*)
10 pounds ears of maize	0.560	6.840
5 » alfalfa hay	0.355	1.711
5 » timothy hay	0.110	2.151
	1.025	10.702
8 pounds oats	0.696	5.4048
4 » alfalfa hay	0.284	1.3692
6 » timothy hay	0.132	2.5812
	1.112	9.3552
5 pounds maize grain	0.350	4.275
2 » cowpeas	0.338	1.5892
0.5 » cottonseed meal	0.177	0.4672
5 » maize stalks	0.080	1.581
5 » sorghum fodder	0.075	1.610
	1.020	9.5224
5 pounds cowpeas (coarsely ground)	0.845	3.973
5 » molasses	—	2.769
10 » oat straw	0.080	3,481
	0.925	10.223
8 pounds rolled barley	0.664	7.1952
4 » alfalfa	0.284	1.3692
5 » prairie hay	0.145	2.021
	1.093	10.5854
7 pounds maize grain	0.490	5.985
1 » cottonseed meal	0.354	0.9346
4 » cowpea hay	0.368	1.5036
6 » maize stalks	0.096	1.8972
	1.308	10.3204
8 pounds maize grain	0.560	6.840
4 » cowpea hay	0.368	1.5036
6 » maize stalks	0.096	1.8972
	1.024	10.2408

TABLE III. — *Ration for horses on medium work, per* 1000 *pounds of live weight.*

(Theoretical requirement 1.40 pounds protein and 12.40 therms energy).

Ration	Protein (*Pounds*)	Energy (*Therms*)
13 pounds ears of maize	0.728	8.892
6 » alfalfa hay	0.426	2.0538
7 » timothy hay	0.154	3.0114
	1.308	13.9572
12 pounds oats	1.044	8.1072
1 » cowpeas (cracked)	0.169	0.7946
11 » timothy hay	0.242	4.7322
	1.455	13.6340
10 pounds rolled barley	0.830	8.9940
6 » alfalfa hay	0.426	2.0538
5 » prairie hay	0 165	2.021
	1.421	13.0688
11 pounds maize grain	0.770	9.405
6 » cowpea hay	0.552	2.2554
6 » maize stalks	0.096	1.8972
	1.418	13.5576
5 pounds cowpea hay	0.460	1.8795
9 » maize stalks	0.144	2.8458
19 » maize grain	0.700	8.550
0.5 » cottonseed meal	0.177	0.4673
	1.481	13.7426

TABLE IV. — *Ration for horses on heavy work, per* 1000 *pounds of live weight.*

(Theoretical requirement, 2 pounds protein and 16 therms energy).

Ration	Protein (*Pounds*)	Energy (*Therms*)
12 pounds oats	1.044	8.1072
2 » bran	0.216	1.0600
8 » timothy hay	0.176	3 4416
5 » clover hay	0.245	1.9340
	1.681	14.5428
12 pounds maize grain	0.840	10.260
1 » soya beans (ground)	0.273	0.8129
12 » alfalfa	0.852	4.1076
4 » maize stalks	0.084	1.2648
	2.049	16.4453
7 pounds peanuts (ground with hull)	1.183	5.8205
7 » cane molasses	—	3.8766
7 » pea hay	0.644	2.6313
7 » timothy hay	0.154	3.0114
	1.981	15.3428
10 pounds rolled barley	0.830	8.9940
2 » gluten meal	0.562	1.6830
8 » alfalfa	0.568	2.7384
6 » prairie hay	0.154	2.4252
	2.134	15.8406
5 pounds cowpea hay	0.460	1.8795
9 » maize stalks	0.144	2.8458
13 » maize grain	0.910	11.115
1.5 » cottonseed meal	0.531	1.4019
	2.045	17.2422

with (*a*) the influence of local conditions ; (*b*) the conditions which determine the selection of foods and their combination to obtain the correct proportions of their nutrient elements ; (*c*) the method of adjusting the rations for light draught horses and heavy work-horses They then pass in review the principal foods and finally give a list of rations previously fixed per 1000 pounds live weight for resting horses and for horses on light medium, and severe work respectively. This list is reproduced in the Tables which give an idea of the typical rations for agricultural horses used in the United States ;—

342 – **Cattle-Feeding on Pasture in the United States.** — COCHEL, W. A., in *The Breeders' Gazette*, Vol. LXXVI, No. 8, pp. 307-308,1 fig. Chicago, Aug. 21, 1919. CATTLE

Description of the methods of feeding butchers' cattle on pasture adopted in the principal pasture areas in the United States, with a list of the types of grasses most commonly used for supplementing the grain ration given to cattle. Blue grass (*Poa pratensis*), with the white clover which accompanies it, is the standard pasture grass of the older farming parts of the United States. In the south, pastures of Bermuda grass (*Cynodon Dactylon*) predominate, accompanied by *Lespedeza striata*. On the Pacific slope the standard pasture is of *Alopecurus* and *Medicago falcata*. The grass lands of the Flint Hill region (Kansas) and the Osage Country (Oklahoma) are of bluestem (*Andropogon furcatus*) and side-oat gramma (*Boutelona oligostachya*), while the plains region, known as the Short-Grass country, is the home of buffalo grass (*Buchloe dactyloides*) and of the short gramma. The two last mentioned grazing areas are not provided with leguminous plants and are, consequently, chiefly used for grazing mature steers or for maintaining breeding herds.

Pastures of *Poa pratensis* are much used for fattening yearlings ; calved in spring, they are turned out to pasture about May 1 in the following year for sale about the end of the summer or early in the autumn. While the grass is tender the cattle consume only about 10 pounds of grain daily per head ; when the grass loses its succulence the appetite for grain increases, and they consume double that quantity. When the consumption of grain increases, it is advisable to use from 1 ½ to 2 pounds of nitrogenous concentrates per head daily, which gives the cattle a much better finish than is obtained from the ration pasture + maize grain, so that at the beginning of October the animals reach a weight of from 1100 to 1200 pounds and fetch the highest market prices.

Another system fairly generally followed is to half-feed two-year-old steers during the winter, then, in May and June they are grazed without any supplementary grain ration ; full feeding commences in July and continues up to the end of September or the beginning of October. Another system is to winter the cattle, as much as possible, without grain ; they are turned out to graze at the beginning of May without giving grain until the grass begins to fail ; then a supplement is given of maize grain, or in favourable years green maize ears fed directly in the field, in gradually increasing amounts. With this system the animals attain a high finish by the beginning of November.

In grazing districts where leguminous plants do not abound, cottonseed cake is generally fed instead of maize grain. The cattle used in these districts are generally older than those used in the bluegrass pastures. They are frequently half-fed during the winter so that they may go on grass in a high condition in spring, and be ready for market towards the end of June or early in July before the abundance of cattle in the market depreciates prices.

A frequent practice on natural pastures, which are at their best in July and August and fail utterly after the first hard frosts, consists in taking off the cattle at the beginning of September and keeping them for 60 to 90 days on a fattening ration without pasture, so as to sell them when the greater number of animals handled under similar conditions has been marketed. This method gives very good results with high grade steers.

343 – **Feeding Dairy Cows with Purchased Foods only, in California.** — WALL, F. W. (University of California), in *Hoard's Dairyman*, Vol. LVIII, No. 1, pp. 5-7, 9 fig. Fort Atkinson, Wis., July 25 1919.

The author investigated, as an example of a dairy where the animals are fed exclusively on purchased food, a dairy establishment situated near Los Angeles (California), belonging to a creamery company ; which has a herd of 330 Holstein cows.

The cows are rigorously selected, those whose production is inferior being discarded ; a daily production of over 300 pounds of butterfat is thus obtained for the whole herd, which includes 20 % of two-year old heifers with their first calf.

The feeding system is as follows:— All cows receive, in racks, alfalfa hay or green alfalfa. Dry cows are given only maize silage in addition. Cows at the beginning of lactation, which are milked twice a day, receive, in addition, about 14 pounds of concentrates per head daily, namely a mixture of 5 pounds of dried beet pulp + 5 pounds of wheat bran + 4 pounds of coconut meal ; cows in full lactation, milked 3 times a day, receive an additional 4 pounds of a mixture of equal parts of wheat bran rolled oats and barley. The quantity of grain given is gradually decreased as the milk flow decreases so as to feed approximately one pound of grain for every 3 ½ to 4 pounds of milk produced.

To belong to the group milked 3 times a day, young cows must produce at least 30 pounds of milk per day and mature cows at least 40 pounds. The average production of butterfat for the cows milked 3 times a day is 2 pounds and for those milked twice a day 1.5 pounds.

The milch cows consume, on the average, 15 to 18 pounds of alfalfa hay (or its equivalent green) and 20 to 25 pounds of maize silage per head per day. The relatively low amounts of roughage and high amounts of concentrates are justified by the fact that the former, delivered at the dairy, has such a high cost that it exceeds that of the latter, on the assumption (which is justified) that 2.2 tons of good alfalfa hay have a similar feeding value to 1 ton of mixed grain.

The prices of foods in dollars per ton are as follows :— Alfalfa hay, 22.10. Green alfalfa, $5.00. Maize forage ($3.50 a ton) + transport nd handling at silo ($1.50 to $2.00 a ton), $5 to $5.0. Dried beet ulp and wheat bran, $45. Rolled barley, oats and cocoanut meal, $60.

The maize silage is fed at milking time together with the grain ration. he alfalfa hay is cut into ¼ to ½ inch lenghts which effects a saving f 25 %.

The dairy is associated with the local county cow-testing Association. he grade cows (which are gradually being replaced by pure-breds) are hus sold with a guarantee of a minimum production of butterfat at good rices and to the satisfaction of the purchaser.

Another good source of revenue is the sale of calves. The calves get p to 6 quarts of whole milk a day, in individual pails, for 6 to 8 weeks, nd are then gradually accustomed to skim-milk supplemented with good lfalfa hay and a mixture of bran, oats and barley with a little coconut neal ; the mixture is increased gradually from a fraction of a pound to or 3 pounds per head daily. When they have reached a suitable age, he calves are sent to hill pastures, with bred heifers, for 5 months.

44 – **Experiments on the Food Value of Clover versus Alfalfa for Milk Production in Ohio.** — HAYDEN, C. C. in the *Bulletin of the Ohio Agricultural Experiment Station*, No. 327, pp. 1-36. Wooster, Ohio, July, 1918.

Experimental tests were conducted at the Agricultural Station of Ohio (United States) chiefly owing to the difficulties of alfalfa cultivation n a considerable part of the eastern territory of the Ohio State, because f the type of soil and the scarcity of drainage systems These difficulties re the most noticeable in the North-east of the State, which specialises nore in the milk industry. The cultivation of clover does not, on the ther hand, present any difficulty, provided that there is sufficient lime.

PLAN OF THE EXPERIMENTS. — As many cows as were available ere used for feeding tests each year ; and they were divided into two ots as nearly comparable as possible Each of them received alternately, lfalfa and clover, making the feeding periods as long as possible Exclu- ive of the hays, the rations were identical in quality. To prevent he leaving of feed not selected by the animals, rations were given in re- ular proportions, to be cleaned up entirely. These tests were repeated years in succession.

RESULTS OF THE TESTS. — The adjoining Tables show the quan- itative data relative to the 4 series of tests. Table I shows that, on the hole, more food was consumed and more milk produced while the cows ere on the alfalfa rations, but that the difference in the quantity of feed onsumed, was greater than the difference in quantity of product. The reatest difference in milk was noted in the first test when the clover was f the poorest quality.

The alfalfa rations contained 31.8 % more protein than the clover ations, and 8.2 % more carbohydrates and fats ; however, the cows on lfalfa produced only about 9.5 % more milk ; and this difference would ave been still less if the clover in the first test had been of good quality.

The average nutritive ratio during the four tests was 1 : 8.6 for clover rations and 1 : 7 for alfalfa rations. Both these rations were lower in protein than the accepted standard, therefore there was not any over-supply of protein with the alfalfa. Theoretically, the alfalfa should have caused greater production per unit of hay, especially when the quality of the two hays is considered.

The gain or loss in weight of the cows, which are fairly high, should be taken into consideration. In Test I, the cows on clover lost in weight about 1 pound daily, whilst those on alfalfa gained about 0.7 pound daily. In Test II, the cows on clover lost about 0.7 pound daily, and those on alfalfa gained in the first period and lost in the second, an average loss of about 0.1 pound daily. In Tests III and IV, the final differences in weight were less obvious, and this partly explains the fact that the clover was of the second cutting, harvested in full bloom. It is obvious also that the cows selected for the tests were in the early part of their lactation periods, when the tendency to draw from their bodies is strongest if the supply of nutrients is short in the feeds. This would be the case with the poor quality clover rations from the point of view of proteins.

Conclusions. — Alfalfa appears to be a better digestive than clover, with more stimulative action. When the hays are of equal quality, neither can be said to be greatly superior for milk production, but the alfalfa showed a stronger tendency to miantain the weight of the animals.

Table I. — *Summary of milk production and food consumption in 4 tests.*

Test	Production		Feed consumed					
	Milk	Fat	Maize	Bran	Silage	Stover	Clover	Alfalfa
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Clover periods:—								
First	8779.4	340.7	3068.0	—	11334.0	—	4908.0	—
Second	9290.0	402.4	2185.0	1092.5	10746.0	1190.5	3444.5	—
Third	5591.8	243.5	1381.2	690.6	6952.0	838.2	2271.0	—
Fourth	7704.0	292.2	2137.5	—	8526.0	—	4253.0	—
Total	**31365.2**	**1278.8**	**8771.7**	**1783.1**	**37558.8**	**2028.7**	**14876.5**	—
Alfalfa periods:—								
First	10832.7	412.2	3301.5	—	12747.4	—	—	62[illegible]
Second	10316.6	438.3	2521.0	1260.5	12455.6	1354.4	—	42[illegible]
Third	5578.4	230.7	1411.2	705.6	7045.5	901.5	—	23[illegible]
Fourth	7543.6	293.1	2137.0	—	8536.0	—	—	42[illegible]
Total	**34271.3**	**1374.3**	**9370.7**	**1966.1**	**40784.5**	**2255.9**	—	**170 4**
Difference	**2906.1**	**95.6**	**599.0**	**183.0**	**3225.7**	**227.2**	—	**21 9**
Percentage of difference	**9.3**	**7.5**	**6.8**	**10.3**	**8.6**	**11.2**	—	[illegible]

The clover rations showed a smaller amount of digestible protein consumed per 100 pounds of milk produced. It is probable that the cows may have drawn on a certain amount of their organic nutritive reserves to supply the deficit; for 100 pounds of milk produced, the total nutrients consumed were a little greater with the alfalfa rations.

The superiority of the alfalfa over the clover lies chiefly in the fact that: — (1) it makes it possible to obtain a stronger production; (2) it has an appetising effect rather than a high protein content. The results of these tests indicate that a unit of clover protein is more efficient in milk production than a unit of alfalfa protein.

The analytical data of the test results is given in an appendix containing 36 individual summaries.

TABLE II. *Digestible Nutrients Consumed.*

Feed	Protein	Carbohydrates	Fats	Carbohydrates + 2 ¼ fats	Protein per 100 lb. milk	Carbohydrates + 2 ¼ fats per 100 lb. milk
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Clover periods:–						
Maize	657.9	5947.2	403.5	—	—	—
Bran	222.9	741.8	53.5	—	—	—
Silage	413.1	5633.8	262.9	—	—	—
Clover	1130.6	5846.5	267.8	—	—	—
Stover	42.6	860.2	14.2	—	—	—
Total	**2.467.1**	**19029.5**	**1001.9**	**21283.8**	**7.86**	**67.19**
Alfalfa periods:—						
Maize	702.8	6353.3	431.0	—	—	—
Bran	245.8	817.9	59.0	—	—	—
Silage	448.6	6117.7	285.0	—	—	—
Alfalfa	1808.6	6654.3	153.6	—	—	—
Stover	47.4	956.5	15.8	—	—	—
Total	**3253.2**	**20899.7**	**944.9**	**23025.7**	**9.49**	**67.19**

45 – **Variations in the Quantity of Milk Produced by Ayrshire Cows and its Fat Content.** — PEARL, R. and MINER, J. R., in *Journal of Agricultural Research*, Vol. XVII, No. 6, pp. 285-322, 6 diagr., bibliography of 30 works. Washington, Sept. 15, 1919.

For a genetic study to be critical, it is essential that it should be based on a sufficiently comprehensive knowledge of the normal variations of the character considered, independently of factors of genetic significance. This consideration becomes particularly significant when the character in question is subject to conditions of environment, as is specially the case in the milk production of cows.

The authors have, consequently, undertaken a biometrical analysis of the normal variation in the quantity of milk production of Ayrshire cows

per unit of time and in quality as indicated by the butter fat content. Their aim was to establish normal constants for inter-individual variation in these characters which would serve as a basis in future genetic studies on milk production.

The investigation was based on the records of production of Ayrshire cows published in the Reports of the Ayrshire Cattle Milk Records Committee of Scotland, compiled by SPEIR and HOWIE. These Reports contain :— Total quantity of milk produced (in gallons); Average percentage of fat, determined by periodic tests; Total quantity of milk calculated on a 3 % fat basis; Number of weeks in lactation period; Age of the cows; Date of last calving; Miscellaneous information about the cow, particularly of abnormal circumstances of any sort during the test. The Report for 1908 includes 8132 cows and that for 1909 includes 9202.

The authors deal, in a series of Tables and diagrams, with the following points, which are then discussed. — Frequency distributions for variations in average weekly milk yield of Ayrshire cows of different ages; Frequency distributions for variations in percentage of fat in the milk of Ayrshire cows; constants for variation in weekly milk yield; constants for variation in percentage of fat in the milk; coefficients of variation for various characters; analytical constants for variation in average weekly milk yield; constants for variation in fat percentage; constants of the component normal curves in the variation in average weekly yield; comparison of average weekly yields at different ages with those calculated on the assumption that the change is logarithmic; average fat percentage at different ages.

RESULTS. — (1) The average weekly yield and fat percentage of the milk change in a considerable degree and in a definite manner with the age of the cow.

(2) The weighted average standard deviation and coefficient of variability for average weekly yield of cows of any given age are 2.806 gallons and 17.081 % respectively. These values may be considered as very close approximations to true normal values. For cows of all ages, taken collectively, the corresponding values are 3.329 gallons and 20.816 %.

(3) For fat percentage the weighted average values for cows of any given age are: — Average, 3.738; standard deviation, 0.330; coefficient of variation, 8.827.

(4) About one half of the variation in milk production results from varying genotypic individuality of the animals with respect to this character: the other half results from varying influences of environment.

(5) Milk production curves, analytically considered, tend definitely to a positive skewness, both for yield and quality. The weighted average value of the skewness for average weekly yield is + 0.1047 and that for fat percentage is + 0.1338.

(6) Selection can have had little or no influence in determining the direction or the amount of skewness in the milk production curves.

(7) The curves for milk yield tend, on the whole, to be more frequently

unlimited range types, while those for fat percentage tend more to nited range types. The estimation of range limits given by the theoretical curves is, on the whole, good.

(8) In general. the tendency of milk yield curves is toward the leptokurtic condition, that is to say, they are more acute then the corresponding normal curves. Fat percentage curves do not show any definite tendency th respect to kurtosis.

(9) Certain of the milk yield curves were dissected into two normal rves by PEARSON'S method. The resulting graduation was not so good that given by the appropriate, unimodal skew frequency curve. There no evidence that variation curves for milk production curves are omodal.

(10) The change in average weekly yield of milk with advancing e is represented by a logarithmic curve and is in accordance with a w which may be stated in the following way :— The absolute amount milk produced per unit of time increases with the age of the cow until e maximum is reached, but the rate of increase diminishes with advancing e until the absolute maximum of production is reached. After the ne of maximum productivity, the absolute production per unit of time creases with advancing age at a continually increasing rate.

(11) The average fat percentage of the milk diminishes with advancg age until the cow reaches her 10th year. Thereafter the fat percentage mains approximately constant during the remaining lactation periods.

5 – **Lamb Feeding Investigations in Kansas, in 1919.** — PATERSON, A. M., in *Agricultural Experiment Station, Kansas State Agricultural College, Department of Animal Husbandry, Circular* No. 79, pp. 4, 1 fig. Topeka, Oct. 1919. SHEEP

250 lambs were bought in the Kansas City market at $16 per cwt., nt to Manhattan on Feb. 26, 1919, and fed on silage and maize dder up to March 9; they were then divided into 7 lots of 35 ch and submitted to a food test lasting 49 days. The initial ration r each lot of 35 heads was 6 pounds of grain + 2 pounds of protein pplement + 20 pounds of alfalfa hay + 35 pounds of silage. Lots hich received no silage were given 40 pounds of alfalfa hay per day. The itial ration was gradually increased, care being taken to see that it as always entirely consumed. The lambs were quartered in an enosure provided with a shed and had access to fresh water and salt at times.

The more important data relating to this test are given in the follow- Table. The cost of the foods were :—

	$		
Maize grain	1.50	per	bushel
Linseed meal	65	»	ton
Cottonseed meal	65	»	»
Maize gluten feed	63	»	»
Hominy feed	60	»	»
Alfalfa hay	30	»	»
Maize silage	8	»	»

Results of lamb feeding investigation.

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI	Lot VII
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Daily ration per lamb:—							
Maize grain	1.24	1.24	1.24	1.24	—	—	1.24
Hominy feed	—	—	—	—	1.24	—	—
Linseed meal	0.16	—	—	—	—	1.14	—
Cottonseed meal	—	—	0.16	—	—	—	—
Maize gluten feed	—	0.16	—	—	—	—	—
Alfalfa hay	1.04	1.04	1.04	1.04	1.08	1.16	2.14
Maize silage	1.52	1.52	1.52	1.52	1.58	1.78	—
Initial weight per lamb	64.56	65.40	66.08	65.23	65.62	65.21	65.23
Final weight per lamb	84.27	81.14	82.94	79.12	80.00	80.61	84.11
Total gain in live weight per lamb	19.71	15.74	16.86	13.89	14.38	15.40	18.88
Average daily gain per lamb	0.40	0.32	0.34	0.28	0.29	0.31	0.38
Food consumed per 100 pounds of gain:—							
Maize grain	308.20	386.02	360.38	437.44	—	—	321.82
Hominy feed	—	—	—	—	422.53	—	—
Linseed meal	30.77	—	—	—	—	362.73	—
Cottonseed meal	—	—	46.50	—	—	—	—
Maize gluten feed	—	49.81	—	—	—	—	—
Alfalfa hay	258.85	323.77	302.25	366.88	368.01	369.09	555.40
Maize silage (1)	377.87	473.19	441.76	536.21	538.39	560.36	—
	$	$	$	$	$	$	$
Cost of food per 100 pounds of gain in live weig.	15.02	18.74	17.56	19.44	20.38	19.61	17.00
Initial cost per lamb	10.37	10.71	10.82	10.68	10.73	10.67	10.68
Cost of food per lamb	2.96	2.95	2.96	2.70	2.93	3.02	3.21
Cost of labour per lamb	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Interest at 8 % on capital per lamb	0.113	0.115	0.116	0.114	0.115	0.114	0.11
Interest at 6 % on equipment per lamb	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Shipping and marketing expenses per lamb	.43	.43	.43	.43	.43	.43	.43
Total cost per lamb at Kansas City	14.473	14.605	14.880	14.334	14.605	15.634	14.8
Selling price per cwt. at Kansas City	19.00	18.25	18.75	18.50	18.40	17.75	18.8
Selling price per lamb at Kansas City	16.01	14.81	15.55	14.66	14.72	14.31	15.8
Profit (+) or loss (−) per lamb	1.537	+ 0.205	+ 0.824	+ 0.316	+ 0.115	− 0.324	+ 1.0

(1) Maize silage made in August from maize injured by hot winds.

RESULTS. — (1) Linseed meal is more efficient than maize glute feed as a protein supplement for fattening lambs when fed with mai grain, alfalfa hay, and maize silage.

(2) The addition of linseed meal or cottonseed meal as a protein su plement to a ration of maize grain, alfalfa hay and maize silage, reduc the cost of production per unit gain of live weight, and increased t selling price per unit and the profit.

The addition of maize gluten feed as a protein supplement to a r tion of maize grain, alfalfa hay and maize silage, increased the gain

eight, diminished slightly the cost of gain per unit of live weight, but iled to produce the desired finish and gave less profit than when no pro- in supplement was used.

(3) The substitution of hominy feed for maize grain with a ration of lfalfa hay and maize silage increased slightly the gain in live weight, but so increased the cost of that gain. It also failed to produce the high nish that maize grain did, which made the ultimate profit less.

(4) Maize silage added to a ration of maize grain and alfalfa hay was t profitable except when linseed meal was added, in which case the ghest profit was obtained.

(5) Linseed meal substituted for maize grain and fed with alfalfa hay d maize silage increased the live weight slightly more than when maize ain was fed with alfalfa hay and maize silage, but the former ration iled to produce the required finish and the sale price per unit of weight as so much less that there was a loss per lamb.

7 – **Breeding and Commerce of Pigs in South Annam** (1). — SCHEIN, H., in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, pp. 369-376. Saïgon, Dec., 1919. PIGS

The breeding and export of pigs forms an important branch of agri- ulture and commerce in South Annam at the present time.

HISTORICAL. — The Moïs tribes bred pigs for their food from time mmemorial, without having ever made an important trade of it. On e other hand, the Chams, by religion Braminists and later Mahomedans, oscribed all contact with this " unclean " animal, whose breeding could t be revived in the coastal deltas until after the sanguinary wars which ded with the victory of the Annamites.

But this breeding has only recently expanded to its present limits owing the peaceful penetration of the Chinese at Singapore. Although great ork-eaters, the Chinese of the Malay Peninsula scarcely breed any pigs, eing employed as coolies in the tin mines, on plantations and in factories. xcept Southern China, and Indo-China (French, British or Siamese) e other countries near the Malay Peninsula regard the breeding of pigs d their use as food with disapproval. Indo-China is thus, in conjunc- on with China, Siam and Burma, indicated as pork provider of the Chi- ese in Singapore.

BREEDS OF PIGS. — The breeds of pigs in South Annam are the same s in the whole of Indo-China. They have been well described by . BAUCHE (The Pigs of Indo-China, *Bulletin économique de l'Indo- ine*, 1902, p. 841), so the author only gives a few details on this subject.

(1) This article forms a useful supplement to the paper by M. DOUARCHE on " Indo-Chi- se Breeding ", summarised in *R.* March, 1919, No. 233, which deals with breeding in general d especially that of cattle. As for sheep, " they are ", M. DOUARCHE says, " practically n-existent in Indo-China and there is scarcely any chance of their increasing there ". On e other hand, an article by M.M. AUG. CHEVALIER and P. A. LAPICQUE, dealt with in *R.*, t.-Dec. 1919, No. 1199 sketches the future possibilities of pig breeding on a large scale in ndo-China; that article also deals with the utilisation of " luc-binh " or water hyacinth, hich abounds throughout the Colony, for fattening pigs. (*Ed.*)

They are, or rather were, 3 in number.

(1) *Delta or Tonkinese breed.* — A small pig, concave, sub-brevilinear. 20 years ago this was the commonest breed in the Annamite villages. It has so completely disappeared since then, that out of about 7000 pigs exported, not one of this breed was seen in 1919; hardly any of the animals examined seemed to show traces of cross-breeding. This fact is apparently due to several causes:— small size; decidedly inferior quality of meat and lard, soft, flabby almost hydrohaemic; voracity; probably less resistant to sporadic or epizootic diseases. Owing to its defects the disappearance of this breed is not a matter for regret.

(2) *Pigs of high regions* (*Muong pig, Moïs pig*). — Animals of medium size with straight, longilinear profile, with slender legs. Head conical, distinctly elongated; the narrowness of the snout is at once noticeable.

The coat is usually entirely pigmented. But pigs with black skins and white bristles are sometimes seen (about 0.33 %) or with tawny bristles, like the wild boar (about 1 %), or presenting some slight traces of depigmentation of the derma (about 2 %), especially on the snout and on the lower part of the belly. However, the depigmentation is not complete, for the skin is always slightly brownish.

Furthermore, in the Moïs and Tonkinese breeds the pigmentation of the derma is not the same as in the Chinese pig; in the latter the pigmented parts are clearly black with a bluish reflection, while in the two former breeds the coloration is very dark brown with a red reflection.

Although closely related to the wild pig, from which it must have directly descended, the Moïs pig is much quieter in character than the Chinese pig, which is, on the other hand, much further removed from the wild animal. They can be loaded loose in trucks, which is absolutely impossible for Chinese pigs.

The Moïs pig is very hardy; it eats little and fattens slowly. It can, however, reach a considerable size: the author has seen in a Moïs village one of these pigs which must have weighed 200 kg,, but this animal appeared to be 3 years old and the author thinks it would be unprofitable to keep a pig so long. Generally pigs are sold at 14 to 16 months old weighing from 60 to 100 kg., sometimes even 120 kg.

The meat is of good quality and the lard fairly firm. The Chinese exporters prefer pigs of this breed and offer a slightly higher price for them, since being hardy and small eaters they can stand the voyage, during which they are inevitably badly fed. A Chinaman told the author that with this breed of pig the losses were 15 % less than those of pigs of Chinese breed.

(3) *Quang-Si breed.* — A little below medium weight; profile straight sometimes slightly concave; sub-brevilinear, stouter legs, wider snout and shorter body than in the preceding breed; back straight, sometimes slightly saddle-backed; the author has not noticed that the loins are badly set on; coat piebald with the white parts of the skin distinctly light pink; the pigmented parts clearly black.

The Quang-Si pig is less hardy than its Moïs relative, eats more

but fattens quicker and easier ; pigs weighing 120 kg. at 14 to 16 months of age are frequently met with. The author thinks that this weight would become general if the pigs were given as much food as they could eat ; he has never seen very old specimens of the breed and cannot estimate what their maximum weight might be.

Breeding. — The breeding is certainly rationally carried out by the Annamites, for it is the only work in which they have realised division of labour. Certain natives own a boar whose services are hired ; others keep sows and sell the produce, but most buy young pigs and fatten them. The agricultural speculations are consequently clearly separated in the matter of pig breeding.

The sow is covered at her owner's place where the boar is kept for 2 or 3 days. When the boar is 2 years old he is castrated, fattened and sold to the local butcher. The sows may have litters of 6 to 12 young ones, rarely 13. The Annamites are present at the littering and give the sow and the young pigs the care required. The sow is covered when she is in season some weeks after littering. She litters 3 times only to avoid risk of weak offspring from a fourth bearing, and is then spayed ; she is then fattened as well as can be, for these sows are not easily fattened.

The young pigs, weaned at 2 ½ months of age, are sold to the fattener at a rate of 2 or 3 *piastres* the pair when the market for pigs is assured by export. They then weigh from 3.5 to 4 kg. The fattener keeps them for 10 to 14 months and then sells them to the butcher or exporter. The average weight of these animals is 1 *picul ;* the market value per *picul* varies from $9 when local consumption forms the only market, to $12 when export is brisk.

Pigs are kept in nearly every Annamite house, generally in a satisfactory state of cleanliness. The pigs roam all day long round the house looking for scraps ; they are fairly well fed with paddy husk, dust of rice husk, cut-up stems of banana plants, cut grass, refuse from the preparation of dried fish, brewers grain, maize (this cereal is much used as food by the Moïs, but the Annamites only use it in case of scarcity, because if maize predominates in the ration, the lard of the pig acquires a yellowish colour).

Domestic pig keeping brings little gain to the Annamite. A system of farming on a share principle even exists with the Chinese, in which the Annamite, unqualified to fix costs, works at a loss and which happily tends to disappear. The Chinaman hands over to the Annamite a pair of young castrated pigs, imported from China by sea and the Annamite undertakes their feeding and maintenance ; the following year they share : — one pig to the farmer and the other to the Chinaman.

The Chinese scarcely ever export any but castrated animals, just as formerly they prohibited the export of silkworm eggs. They try, in fact, to keep the monopoly of improved breeds of animals. The Annamites readily make the comparison of the selfishness of the Chinese with the disinterestedness of the French who strive to introduce into the country everything that can improve local production.

Owing to the shortness of the voyage (2 or 3 days during the north

monsoon), the importation of live animals may lead to the introduction of infectious diseases, specially cattle plague, which is endemic in southern China ; fortunately pigs and cattle are not intimately associated so that the risk of infection is partially limited, but as infection is possible, preventive measures should be taken.

Diseases. — Unlike Central Annam, diseases of pigs are fairly rare in the South : few are verminous or parasitic. Measly pigs are few in number (about 2 %); Moïs pigs are most subject to this disease, owing to the fact that they are village scavengers.

Pig plague is fairly frequent, but when this disease rages the Annamites eat dead and infected animals without giving notice. It is therefore very difficult to follow the progress of this disease among the natives, so that the author has only been able to investigate it on the farm of an European. It is a seasonal disease which is seldom noticed except in May, June and July, in the hot season ; it is said to disappear in September and for the last 5 years it has not appeared in the Nhatrang district.

Export of pigs. — Export from South Annam is chiefly made in junks. Sometimes, however, merchants have bought pigs in the Nhatrang district and have sent them by rail to Saïgon for shipment by steamer. This method of transport is no longer used, in spite of its quickness, because the mortality among the pigs was apparently too high. The pigs, placed in the hold, probably did not get sufficient air ; it is also possible that they did not receive the same care, on the steamer however rough, that they get from the crews of the junks.

The losses in transport by junk are very slight, 5 to 10 % on the average. The profits made by the Chinese engaged in the trade are handsome : the *picul* of pig, bought in Annam at a maximum of $12, is sold at Singapore for $30 to 40.

The fact that the pigs are deck cargo, compels the loading of heavy goods in the hold of the junks. Salt is in these conditions an ideal cargo, for it is in fair request at Singapore, though the rates vary very much from year to year. The junks engaged in the export of pigs frequent ports where salt can be obtained, so that ports serving populous districts, consequently with important trade, ought always to have warehouses of salt for export.

POULTRY

348 – **Genetic Studies in Poultry : Inheritance of Leg-Feathering.** — Punnett, R. C. and Bailey, P. G., in *Journal of Genetics*, Vol. VII, No. 3, pp. 203-213. Cambridge May, 1918.

Results of experimental crosses between a breed with feathered legs (Langshan) and breeds with naked legs (Brown Leghorn and Gold-pencilled Hamburgh).

Generally the F_2 fowls had slightly feathered legs ; but there was considerable variation and one of the hens from a cross with the Hamburgh breed had naked legs, and although crossed with a cock with naked legs she produced progeny with feathered legs.

The F_2 generation of the cross with the Leghorn breed comprised 323 chickens with feathered legs and 106 with naked legs ; the F_2 genera-

ion of the cross with the Hamburgh breed comprised 117 chickens with eathered legs and 31 with naked legs. There was, therefore, a close approach o the ratio 3 : 1.

Fowls of the F_2 generation were, as far as could be judged, identified s homozygous for the character " leg-feathered ". A few F_2 fowls were even heavier leg-feathered than the Langshan breed. Chickens with noderately feathered legs crossed with chickens having naked legs very often produced chickens with heavily feathered legs ; in these cases greater number of cocks were feathered in this way than hens. The author relies on the hypothesis of modifying factors to explain these facts.

On the basis of the data recorded by DAVENPORT the writer suggests hat the character " leg-feathered " in Cochin-China and Dark Brahma breeds depends on 2 factors.

349 – **Sterility of Hybrids between the Pheasant and Gold Campine Fowl.** — CUTLER, D. W., in *Journal of Genetics*, Vol. VII, No. 3, pp. 155-165 + 1 pl. Cambridge, May, 1918.

The author has made cytological investigations on the testes of a dozen ybrids obtained by crossing pheasant cocks and Gold Campine hens ; e has further studied the spermatogenesis of both the pheasants and Gold Campine cocks.

Technical difficulties rendered the determination of the number of chromosomes uncertain. The hydrids had from 18 to 20 in the spermatogonia, the pheasants from 20 to 22 and the Gold Campine cocks from 18 to 20. The early development of the primary spermatocytes is normal ; a granular spireme is formed which retracts to one side of the nucleus, producing a closely packed mass of threads. In the next stage spermatogenesis becomes abnormal. The synaptic threads, instead of breaking into bivalent chromosomes, form a varying number of irregularly shaped clumps of chromatin. There is no uniformity as regards the number of the clumps produced, and a series can easily be formed in which the number varies from 2 or 3 large masses up to the condition where the chromosomes are almost all bivalent, or where many have separated as univalents. This failure of the synaptic threads to form bivalent chromosomes is evidently the cause of sterility in the hybrids. This is the final stage in spermatogenesis, for divisions of the primary spermatocytes do not occur, neither is there any trace of abnormal mitosis. There is neither the formation of giant spermatids, as recorded for hybrid pigeons by GEOFFREY SMITH, nor production of multiple spindles, as found by GUYER in hybrid pigeons and by WODSEDALEK in the testicles of a mule.

350 – **Note on Indo-Chinese Birds whose Feathers are used by the Annamites or are Exported.** — DEMANGE, in *Bulletin économique de l'Indochine*, Year XXII, New series, No. 138, pp. 710-728 +12 plates Hanoï-Haïphong, Sept.-Oct., 1919.

Desiring to introduce a little precision into his notes on feather fans and hats, published under the title of " Little Trades " in the *Bulletin*

économique de l'Indochine (Year. XXI, No. 131, July-Aug., 1918), the autho has been led to interest himself in birds, principally aquatic birds, whic are the object of a fairly important trade.

A basic investigation enabling the different kinds of birds and th different genera of the group of "Crab-eaters" (the most importan among the feather producing waders), to be distinguished, was of chie importance, for the value of feathers varies considerably from one specie to another.

The author has succeeded in unravelling to a great extent the histor of ornamental feathers, and that of the birds which produce them. He has used the work of Dr. G. Tirant, *Les oiseaux de la Basse-Cochinchine* and the *Décades Zoologiques* of the Scientific Mission of Exploration in Indo-China. He has reproduced the complete synonymy and the principal information given in these two somewhat inaccessible works.

The observations which he has made himself in Tonkin are not always in agreement with those of Cochin-China, which is not surprising the two countries each having certain species which are peculiar to them geographical races and varieties must perforce be created.

For the correct use of the vernacular names, the fixing of the pric of feathers, their method of use, the author had recourse to various maker of hats and fans, and to the native bird-catchers.

The number of birds dealt with by the author in the present not is 38, of which 14 are Ardeidae (herons and crab-eaters) The followin is the list (recognized scientific names and common names) : —

Picidae : *Centropus sinensis*, greater cuckoo or pagoda cock.

Alcedinidae : — 1) *Alcedo bengalensis* and 2) *A. meninting*, lesse Kingfishers ; 3) *Entomolia pilcata*, black-hooded, white-necked Kingfisher 4) *T. smyrnensis*, brown-hooded Kingfisher.

Oriolidae : *Oriolus indicus*, Indian oriole.

Corvidae : — 1) *Corone insolens*, black rook ; 2) *C. macrorhynch* white-necked rook ; 3) *Urocissa sinensis*, Chinese jay.

Phasianidae : 1) — *Pavo muticus*, peacock; 2) *Polyplecton germai* spur-fowl or polyplectrum ; 3) *Numido meleagris*, guinea-fowl.

Gruidae : — *Grus antigone*, ash-coloured crane.

Ardeidae : 1) — *Ardea cinerea*, ash-coloured heron ; 2) *A. sumatran* grey heron ; 3) *A. purpurea*, brown heron ; 4) *Herodias trorra*, great white egret ; 5) *H. garzetta*, lesser white egret ; 6) *Bubuleus coromandu* buffalo heron ; 7) *Ardeola prasinosceles*, common crab-eater ; 8) *grayi*, white crested crab-eater ; 9) *Gorsachius melanophus*, bittern ; 1 *Nycticora griseus*, common night heron ; 11) *Butorides javanica*, gre bittern or barred heron ; 12) *Ardetta flavicollis* black bttern ; 13) *Acin momea*, cinnamon bittern ; 14) *A. sinensis* Chinese bittern.

Ciconiidae : — *Leptoptilos javanica*, black-legged marabout.

Tantalidae : — 1) *Tantalus leucocephalus*, white-headed tantal 2) *Ibis melanocephala*.

Rallidae : — *Porphyros edwardii*.

ANATIDAE: — 1) *Anas boschas*, wild duck; 2) *Querquedula circia*, nter teal.

ANSERINAE: *Anser cinereus*, wild goose.

PELECANIDAE: 1) *Pelecanus javanicus*, white-tufted pelican; 2) *P. phi-pensis*, grey pelican; 3) *Phalacrocorax carbo*, black cormorant; 4) *otus melanogaster*, serpent necked anhinga.

BEE-KEEPING

– Observations on the Formation of Sex in Bees. — I. DEVAUCHELLE, in *L'Apiculteur*, Year LXIII, No. 12, pp 285-288. — II. DECONDRÉ, E., *Ibt.*, pp. 288-290. Paris, Dec., 1919.

Observations disproving the theory according to which the queen-e lays only fertilised eggs, and that it is the working-bees who deter-ne the sex, and confirming the theory of DZIERZON, according to which e queen-bee lays fertilised eggs from which are derived working-bees d females (according to the food given by the working-bees), and un-tilised eggs, from which only males can be derived. The unfertilised gs of humble-bee queens can only give false drones.

I. — Experiments showing that, in a hive deprived of its queen, 4 ma-rnal cells in the breeding cells of males can give males.

If, in this abnormal case of maternal breeding in breeding cells of ones, the eggs had been fertilised, the bees of a colony which was normal ould have infallibly bred young females. And if the attendant bees termine the sex, how, when they had such need of replacing the sup-essed queen, could they only breed drones with eggs laid in big cells?

II. — Experiments showing that it is sufficient, at the end of the summer, soon as the breeding of false drones and the false drones themselves ve ceased to exist in the hive, to suppress suddenly the queen bee of a ve possessing only breeding cells of working-bees, and that the tendant bees can indeed bring up females, but that it will be impossible r them to transform the eggs or the breeding cells of working-bees into lse drones.

2 – Photic Reactions of Honey Bee. — MININICH, D. E., in *The Journal of Experimental Zoology*, Vol. XXIX, No. 3, pp. 343-425 (Authors' summary p. 342), 17 fig., Bibliography of 50 works. Philadelphia, Pa., Nov. 20, 1919

Light exerts a kinetic influence on the honey bee, and the bee with blackened eye generally loops towards the functional eye. The reactions normal bees and with bees with blackened eyes. when creeping in di-ct or indirect light have been studied. The apparatus used to fur-sh non-direct light consisted of an electric lamp surrounded by a reen inside a white walled cylindrical chamber. Two intensities of umination were employed; 24 m. c. and 957 m. c. Drawings were made the deflective movements of each of the bees studied, determining the verage number of degrees turned for each loop or series of loops in the me intensity of light. By comparing the four first pairs of determina-ons thus obtained, from each of the 52 bees under consideration, it was und that in 81 % of the cases, the bees turned more toward the func-onal eye in an illumination of 957 m. c. than in one of 24 m. c. There is,

then, a direct relation between the intensity of uniform light stimulus (the type furnished by the apparatus) and the tendency to turn towards the functional eye.

The orientation stimulation is really of a continuous nature, and as the process involved in circular movements is identical with that involved in normal orientation, the continuous action of light must be the effective factor in the photic orientation of the normal bee.

SERICULTURE

353 – **Progress of Sericulture in Indo-China** (1). — CABANES, R., in *Bulletin économique de l' Indochina*, Year XX, New series, pp. 782-784 + 5 graphs. Hanoï-Haïphong, Sept.-Oct., 1919.

The author gives a detailed table, accompanied by 5 diagrams, setting forth, for the quinquennal period 1909-1913 and for the years 1914-1915-1916-1917-1918 :—

1) The areas cultivated under mulberry-trees.
2) The quantities of silk-worm eggs set to incubate.
3) The production of fresh cocoons.
4) The production of raw silk.
5) The production of silk materials, waste, silk floss, etc., in Tonkin, Annam, Cambodia, Cochin-China, Laos and in the whole of Indo-China.

The following are some significant figures from this table :—

In Indo-China, the areas cultivated under mulberry-trees have increased from an average of 9610 hectares, during the period 1909-1913 to 13097 hectares, in 1918. The increase was constant and regular. The areas were, and are, greatest in Cambodia, having increased from 6000 hectares in 1909-1913 to 7000 hectares in 1918, that is, from about $^3/_5$ of the total for Indo-China in 1909-1913 to about $^1/_2$ the total in 1918.

For Indo-China, taken as a whole, the quantities of eggs put to incubate have increased, in a regularly progressive manner, from 2961 kg. in 1909-1913 to 4830 kg. in 1918.

Futhermore, the production of fresh cocoons has increased continuously from 4 121 000 kg. in 1909-1913 to 7 286 000 kg. in 1918.

The production of raw silk has increased, in the same way, from 165 840 kg. in 1909-1913 to 291 440 kg. in 1918.

Lastly the production of silk materials, waste, silk floss, etc., has increased progressively and regularly from 206 050 kg. in 1909-1913 to 364 300 kg. in 1918.

While the areas cultivated under mulberry-trees have always been greater in Cambodia (2), the increase in the 4 products quoted below, was not so marked in this country as in Annam and Tonkin, and the two latter have surpassed Cambodia in this respect. Tonkin has become, since 1916, the principal producer in Indo-China.

(1) See *R.*, Nov., 1918, No. 1264 and Oct.-Dec., 1919, No. 1212. (*Ed.*)

(2) On the intensification of sericulture in Cambodia, see *R.*, June 1918, No. 676. (*Ed.*).

In 1918, the 4 products quoted were, in kg. :—

	Tonkin	Annam	Cambodia	Cochin-China	Laos
ggs	16 800	12 600	12 500	5 100	1 300
esh cocoons	2 940 000	1 800 000	1 600 000	751 000	195 000
aw silk	117 600	72 000	64 000	30 040	7 800
lk materials	147 000	90 000	80 000	37 550	9 750

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

54 – **The French Power-Farming Trial Week in Autumn, 1919.** — I. COUPAN, G., in *La vie agricole et rurale*, Year IX, No. 45, pp. 321-334. Paris, Nov. 8, 1919. — II. *Ibid.*, 349-356 (1).

I. — The autumn trial week of power-farming was held on the Sens (Oise) plain from Sept. 29 to Oct. 5, 1919, but the exhibition and the public demonstrations did not begin till October 1. The three previous days were devoted to eliminating trials. Without exaggeration, the whole manifestation was brilliantly successful.

An idea can be formed of the power-farming movement that took place in France during the summer by comparing the number of firms and machines that entered and took part in the Saint Germain (2) and Senlis trials :—

Demonstrations	French makes	Imported from: —			
		United States	United Kingdom	Czecho-Slovakia	Total
aint Germain	19	17	1	—	18
enlis	27	33	1	2	36
ncrease at Senli	8	16	0	2	18
ncrease per cent.	42 %				100 %

France has obviously made considerable progress.

The constant increase in the number of machines, or types of machines, is desirable up to a certain point, but, as far as the trials are concerned, it is counterbalanced by the excessive area required. Obviously, it will be needful to work the machines in public for a few more years, and, as the machines are useless unless they can furnish sufficient work in a given time, the plots allotted to the exhibitors can never be too big, no matter how short the trial. The size of the exhibition would then be out of all

(1) This number is completely devroted to power-farming; other articles of agricultural interest in it will be dealt with in the *Review* for April. (*Ed.*)

(2) For the spring power-farming week, held at St. Germain (Seine et Oise) in 1919, see *R.*, Oct.-Dec., 1919, No. 1222, § I and II. (*Ed.*)

proportion, whether for the number of days over which the demonstrations would be spread or for the time that farmers could devote to it.

As the machines shown at Saint Germain have ready been described in sufficient detail, only those shown for the first time at Senlis or those that have undergone interesting modifications will here be described.

A. — Direct tractors with independent implements.

(1) *Tractors with non-propelling steering wheels.* — These are always the commonest, but the heavy pre-war type, still favoured to a certain extent in North America, has disappeared, not being suited to French conditions. The author describes several :—

Two Rumely-oil-pull tractors, starting on petrol and running on paraffin. The most powerful one has a horizontal twin-cylinder engine, with 178 mm. bore, 25 mm. stroke, and developing 30 H.P. at 530 revs.; two rear steering wheels (diameter = 1.42 m. ; breadth = 0.46 m.); two forward speeds of 3.4 and 4.5 km., and a reverse of 4.2 km. Weight 4362 kg.

The other model has a twin-cylinder horizontal engine of 151 × 203 mm., developing 20 H. P. at 560 revs. Same general arrangement ; driving wheels of 1.30 m. diameter and 0.31 m. breadth ; two forward speeds (3.4 and 5.25 km. per hour) and a reverse (4.2 km). Weight, 3592 kg. In both machines, the engines are oil-cooled.

The 25 H. P. John Deere tractor, with twin-cylinder, horizontal engine running at 400 to 750 revs. per minute. Runs on paraffin and petrol. Bolster-bolt steering axle 1.30 m. in diameter, and with a 30 cm. rim, driven by a small pinion meshing with a large ring fixed inside the rim ; two forward speeds (3.5 and 5 km.) and a reverse. Weight, 2700 kg.

The following tractors have a 4-cylinder vertical engine :—

T. A. F. tractor (Société des tracteurs agricoles français) with a Ballot engine of about 20 H. P. (90 × 150) ; the steering wheels, placed in front, are 1 m. in diameter, with 0.15 m. rims ; the driving wheels are 1.40 m. in diameter and 0.35 m. broad, with strakes or land-grips (flanges for road work and angle irons on a conical rim) that can be adjusted at will. Forward speeds of 4 and 6 km. Weight, 1800 kg.

The Junior type of Nilson tractor, with a 108 × 146 engine, developing 30 H. P. at 900 revs. and 36 H. P. at 1200 revs. Runs on petrol or paraffin. Speed regulator. Cooling by a cellular radiator made of a special metal stated to prevent deposition of tartar. Steering axle pivoting around a horizontal axis ; control by a lever of the touring-car type. Wheels 0,80 m. in diameter and 0,15 m. wide. The power transmission is of interest. It comprises a transverse shaft, driven by chain and pinions enclosed in a gear-case ; the transmission rings are attached to the shaft by means of springs which take up shocks or strain due to slipping the gears in too smartly. This shaft takes : (*a*) between the girders a wheel 1.26 m. in diameter and 0.45 m. broad ; (*b*) on each side outside the girders, a wheel 1.26 m. in diameter and 0.17 m. broad. These

wo lateral wheels can be removed ; when on the machine they are equi-alent, as supporting surface, to a drum 0,79 m. broad, but, as the wheels re provided with special rachets, turning is easier because the central wheel s pulled on at the same speed as the faster-moving lateral wheel. If he lateral wheels are removed the differential is blocked. Unlike most nachines, the tractive effort is not applied to the frame or axle, but to n axle placed quite above the frame. This axle is connected to the plough by a jointed frame and to the chassis by braces fixed near the engine. The result is that, up to a limit corresponding to an effort greater than hat of which the engine is capable (a limit when the tractor would tip orwards), the driving wheels grip the soil with greater force the greater the resistance.

There are other interesting points in this tractor, particularly the susr pension of the radiator. The forward speeds are 3 and 4 km. per hou when ploughing, and 6 to 8 km. on the road. The weight is 2000 kg. with the 3 wheels and 1750 kg. with the median wheel alone.

The SANDUSKI tractor, of American origin, has a 108 × 133 mm. engine, running at 1000 revolutions and developing 25 H. P. It runs on paraffin or petrol and has an air filter. The steering axle oscillates and the control is of the touring-car type. Rear wheels broad and high, driven by an endless screw system. Weight, 2000 kg.

The SEXTON tractor runs on paraffin ; it has a 102 × 152 mm. engine, running normally at 1000 revs. and can develop 30 H. P. ; the two driving wheels, 1.24 m. in diameter and 0.30 m. broad, are furnished with T irons that are easily removed or put on ; the two steering wheels are 0.91 m. in diameter and 0.13 broad at the rims, and are mounted on an oscillating axle and furnished with a control of the touring-car type. Forward speeds of 2.8 and 4.5 km. per hour and a reverse of 2 km. Weight, 2268 kg.

The type 702 F. I. A. T. tractor has a four-cylinder, 105 × 180 engine, running at 800-1000 revs., and normally developing 25 H. P., it runs on paraffin and has a speed regulator. The general arrangement is similar to that of the FORDSON and AUSTIN tractors, i. e., the usual cut-down frame is suppressed and all the necessary connections are established by the different casings which are assembled by bolts.

This casing-frame is attached in front to the steering axle by a single transverse spring, fastened to the axle by two side-pieces, so that the steering can take up any position ; control of the touring-car type ; wheels 0.82 m. in diameter, with 0.125 m. rims. The driving shaft, on the endless screw system, acts on wheels 1.30 m. in diameter and 0.30 m. broad, to which angle-irons can be fitted. Three forward speeds (3 km. 4.5 km., and 6.5 km.) and a reverse (3.75 km.). The pulley is 32 cm. in diameter, with a 17 cm. rim, giving between 100 and 750 revolutions a minute when engaged with the forward speed and between 135 and 400 revolutions when engaged with the reverse. Maximum tractive efforts :— 2500 kg. on 1st speed, 1700 kg. on 2nd, and 1150 on the 3rd speed. Turning radius, 3.10 m. Weight, 2600 kg.

The COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES exhibited, as well as the well-known Titan and Mogul tractors, the 8-16 H. P. International tractor. The 4-cylinder engine is of 101 mm. bore and 127 mm. stroke, and has a strong brace, so that two bearings are sufficient to support it ; cylinders fitted with cast-iron sleeves, bored and turned, easily replaceable in case of wear or cracking ; fuel is paraffin or petrol. Steering wheels 81 cm. in diameter and 10 cm. broad ; driving wheels 1 m. in diameter and 30 cm. broad, driven through a differential and two chains ; 3 forward speeds (3. 4, and 6 km.) and a reverse. Weight, 1500 kg.

Among other machines are :— The Gaulois tractor, which shows a few changes in detail compared with the Galloway ; the La Crosse tractor of MM. GASTON, WILLIAMS, and WIGMORE (Paris), of 25 H. P. and a single wide driving wheel ; the Ceres tractor of the SOCIÉTÉ DES TRACTEURS AGRICOLES CÉRÈS (Paris) ; etc.

Amongst the tractors for small farms and vineyards was the A. CITROËN tractor (Paris) (1). The engine is cylinder, cast in a single piece, of 65 bore, 100 stroke, giving 12 H. P. at 1600 revs. This small and compact tractor (length 2.50 m., breadth 0.86 m.) has a steering axle bearing solid sheet-iron wheels 0.55 m. in diameter and 2 driving wheels 0,90 m. in diameter fitted with strakes ; 2 forward speeds (3.5 and 4.8 km.) and a reverse (3 km.). Weight, 800 kg.

The CHAPRON tractor (Puteaux) (2) is also for small farms and vineyards. The 4-cylinder engine (75 × 130) is kept down to 1200 revolutions by a governor. Total length 2.40 m. ; total breadth 90 cm., base area 1.40 m. Steerings by two coupled wheels of 62 cm. diameter the distance between which can be regulated and which turn around a vertical axis.

The driving wheels, fitted with fixed strakes, are 1.10 m. in diameter and 10 cm., wide, and can be widened to 20 or 40 cm. by adding gripping bands ; 3 forward speeds (2.1, 3.4, and 5 km.) and a reverse. The transmission is fitted with a device for blocking the differential, so that the machine can turn in a radius of 1.40 m. In addition, the engine is placed very low to prevent the machine from turning over on slopes. Weight 1250 kg.

The Abeille tractor of the Globe concern (Paris) is unusual. Intended for small farms and vineyards, its frame is supported by a single chain track 81 cm. long and 30 cm. wide ; the 4-cylinder engine (80 × 115) is watercooled. The whole is supported and steered by two wheels placed behind the engine frame fitted with cutting rings and connected by a triangular conical frame to a pivot on the top of the rear of the frame. The fly-wheel acts on this articulation by a chain wheel. This 12 H. P. tractor weighs 1400 kg. and turns in a radius of 1.50 metres.

(2) *"Total grip" tractors.* — These include chain-track tractors and those with 4 driving wheels.

(1) and (2) See *R.*, June, 1919, n° 758 ; where a Citroën tractor is described and figured and the CHAPRON tractor mentioned. (*Ed.*)

The PEUGEOT machine is worthy of note among the chain-track machines. Fig. 1 shows this machine with the lateral guard plate lifted, so that the chain track can be seen. The 4-cylinder engine (100 × 150 mm.) develops 19 H. P. The transmission, simplified as far as possible, actuates 2 pinions in the rear which drive chains. The chain track, of a special

Fig. 1. — PEUGEOT chain-track tractor.

type, has non-jointed shoes with short axes ; they are guided in front by a pulley and, lower down, by 5 rollers. The frame is also unusual in that it is mounted on two pairs of guides, each placed in a plane perpendicular to the plane of the other. In this way, the engine and transmission are rendered independent of the positions occupied by the chain tracks.

The tractor weighs 2850 kg.

The Italian PAVESI tractor, known as the " Agrophile " is a very curious machine that really consists of two separate carriages, whose wheels are controlled and united or separated as required. The forecarriage, however, comprises the engine, steering, gear-box, etc.

Each carriage consists of a frame ending on one side in an arched rod shaped like a convex arc of a circle and fitted on the under part with a rack. The bearing wheels are 1.20 m. in diameter, with rims 25 cm. wide ; they are mounted on fixed, rigid axles and driven through a differential and chains.

The chief carriage has a horizontal and opposed 2-cylinder engine parallel to the axle ; it has a 130 mm. bore, a 170 mm. stroke, and develops 25 H. P. at 900 revs. There are 2 forward speeds (3 and 6 km., the latter for running on the road) and a reverse, all enclosed with the differential,

and the drive for the second carriage in a casing continuous with that of the engine. The second carriage has only a differential, also cased in.

To assemble the two carriages, they are joined by the arched parts, which thus have a similar function to that of the buffers on tramway trailers and they are fixed by means of a jointed cardan tie-rod on the two axles ; this tie-rod bears, at its centre, a loose pulley which engages with the two racks placed below the curved members. Another shaft with

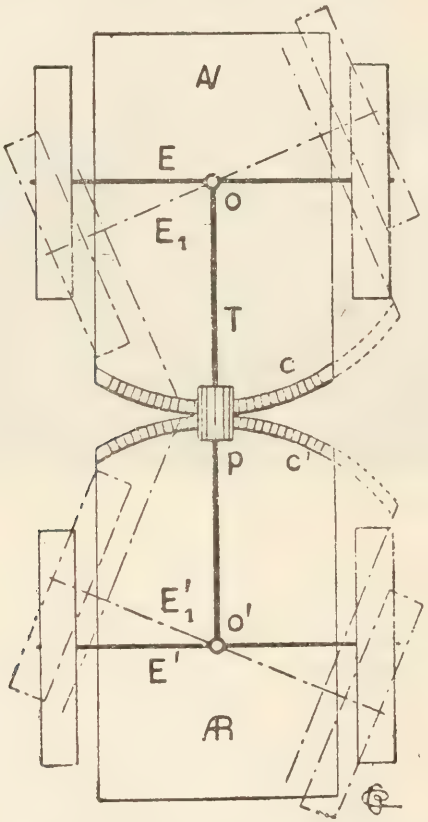

Fig. 2. — Steering of the PAVESI tractor.

a double cardan goes from the gear-box of the main carriage and controls the differential of the second carriage. The four wheels are all driving as well as steering wheels, or, more accurately speaking, the two axles steer. In fact, if the driver moves the steering wheel, the axle *E* of the main carriage *AV* (Fig.) turns obliquely, e. g., to the left to *E*1, which moves the curved members to the right ; the rack *c* carries the loose pinion *p* of the tie-rod *T*, but this, on turning, forces the rack *c'* and the

curved member of the second carriage *AR* to move to the right and, consequently, forces the axle *E'* of that carriage to move to the right and take up the position *E'*1. The two axles are then in such a position that a very short radius is required for turning the tractor; in fact, the external turning radius is 3.25 m.

When it is observed that the articulations *o* and *o'* of the tie-rod *T* on the two axles are cardans, it will be seen that the two carriages can take up any position in a transverse direction compared with each other. Thus the tractor can travel on the most uneven ground, as its two driving axles allow it to overcome obstacles more easily in spite of an average power and relatively light weight (2350 kg.). The usual compensation for complicated transmissions requires total adherence, and the complication is partly avoided in this case by the use of driving and steering *axles* instead of driving and steering *wheels*.

For light work, the driving carriage can be used alone by attaching it to a cart as a fore-carriage; but with both carriages the high tractive effort obtained is sufficient to tow several vehicles.

B. — Direct tractors forming one with the implement.

The firm of the Charrue automobile Henri Amiot (Paris) exhibited the "Gerbe d'or" machine which is of the type of motor plough with a tipping gang, the experimental model of which was described before the war. This principle has been retained:— A double-brabant 3-furrow plough, hooked to the engine frame, lifted with a block, and tipped by means of mechanism driven by the engine.

The 25-30 H. P. Aster 4-cylinder engine has a carburettor that enables heavy oil to be used. Weight, including ploughs, 2600 kg. Normal speeds 4 km. when ploughing and 6 km. when harvesting.

There was also the small Beeman machine, shown by the Société traction et matériel agraires, with a 6 H. P. engine and 2 steering stilts, and which can be used for ploughing on a small scale or for weeding market-garden crops.

The Avery motor-cultivator (Fig. 3) can also be used as a hoe. The working members, of various shapes, are attached to the ends of levers articulated with a cross-bar slung from the frame and can be regulated and lifted by means of levers. The motor frame carries a 4-cylinder 76 × 100 engine, running at 1200 revolutions and thus developing some 10 H. P. Steering is done by a single 70 cm. wheel provided with a central flange, mounted chair-castor fashion on a vertical axis controlled from the driver's seat, which is placed behind the working members. The driving wheels, 1.05 m. in diameter and 15 cm. broad, are chain driven; when turning, 2 pedals block one side or the other of the differential and enable the machine to pivot round the blocked wheel in a small radius; 3 forward speeds (1.6, 2.5, and 4.9 km.) and a reverse (1.6 km.). Weight, 1450 kg. Runs on petrol, benzol, or alcohol.

C. — Single-axle motor-ploughs.

The prototype of these machines is the German Stock plough (described in this *R.*, Nov., 1914, No. 1030) which is designed to furnish a large amount of work on a small consumption. These machines usually consist of a frame shaped like an elongated triangle, supported by an axle which may be in one piece, placed near the base of the triangle ; at the apex there is a wheel provided with a cutting rim which acts as the " sole " and also serves to guide the machine. The engine, always powerful, is placed near the base in front of the axle. The plough bodies, of varying number, are fixed on one of the sides of the triangle, between the axle and the guiding

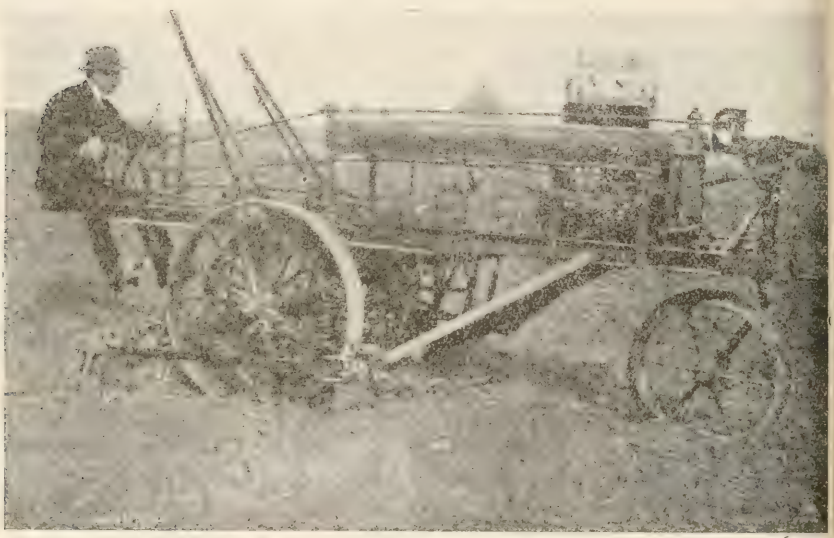

Fig. 3. — Avery-Pilter motor-cultivator.

" sole ". As the latter is not placed in the median plane of the axle, the plough turns more easily one way than the other.

It is advisable that as much of the total weight as possible should be borne by the driving axle, which is always fitted with wheels of large diameter, and this can be done by approximately balancing the weight of the frame and the ploughs by the position of the engine and its accessories. The weight of the two parts must not be balanced exactly, although the reaction of the engine is strongly felt when moving forward, for if the reaction is felt in the inverse movement, it would lift up the gang and cause the machine to tip up. The makers have arranged matters so that normally nothing need be feared from tipping which is actually made use of, as will be seen from the description of the following machines.

The Praga plough (Fig. 4,), made by the PREMIÈRE FABRIQUE CZECHO-MORAVE DE MACHINES (Prague), weighs 4000 kg. and measures 7.20 m. long, 2.25 m. broad, and 2.45 m. high. The two large wheels and the heel support a flat frame, in the front of which is a 4-cylinder, 105 × 106 mm. engine, developing 40 H. P. at 1050 revolutions; the magneto has an independent drive; benzol or petrol can be used as fuel. The plough bodies, 4 or 5 in number, according to the working depth and the resistance of the soil, are fixed on a frame which is joined to the main frame by forks and gudgeons and an endless screw drive, controlled by a hand lever, connects the engine to the device for lifting and earthing the plough bodies; adjustable pieces enable the desired depth to be obtained and kept uniform. As will be seen from the Figure, the driver has a comfortable

Fig. 4. — « Praga » motor-plough.

cabin, with a movable hood for bad weather. There are two speeds, 3.5 and 4.5 km. per hour. This plough can work 4 or 5 hectares in a 10-hour day, at a working depth of 20-25 cm., and with a consumption of 18 to 20 kg. of petrol per hectare.

The Excelsior plough, made by the FABRIQUE DE CHARRUES AUTOMOBILES DE MLADA-BOLESLAV (Czecho-Slovakia), has a single frame, articulated below the two large wheels (1.76 m. in diameter). In the rear, there is a strong "heel", provided with a cutting ring for guidance. The 4-cylinder, 100 × 150 mm. engine develops 35-40 H. P. and drives, through the differential, wheels displaced in height by 20 cm. The forward speeds are 2.4, 3.4, and 4.5 km. per hour and the reverse gives 2.4 and 4.5 km. The gripping strakes are rivetted on the rims; but rims are provided which

can be put on when the tractor runs on the road. The lift system is worked from the reversing gear ; as the support of the heel can slip into a slide, the massive heel only prevents tipping when the gang is lifted ; the support is then at the end of the slide and an automatic pin holds it in that position, and it is then ready for turning. Earthing is brought about by a free fall topped by a wedge suitably placed in special holes, enabling the desired depth to be obtained, no special handling being required while working. The plough has from 3 to 6 bodies and can work at a depth of 40 cm. with three bodies. The total dimensions are :— Length 6.20 m., breadth 2.40 m. The weight is about 5000 kg. It can plough from

Fig. 5. — The new cultivator E. Bauche & Cie.

4 to 6 hectares per 10-hour day, according to the soil, with a consumptio of about 32 litres per hectare when ploughing at a depth of 38 cm. Tw French makers also make use of the reaction of the engine to handle th plough at the end of the furrow, but these machines are so designed as t allow of ploughing without ridges.

M. L. Dubois (Asnières, Seine); makes, under the name of " Poly culteur ", a fore-carriage tractor (with two wheels) that can be adapte to different culture or harvesting implements, even to farm carts. Th polyculteur was working at Senlis with a 3-furrow double brabant. Th 4-cylinder, 90 × 150 mm. engine develops 20-25 H. P. between 1000 an 1200 revolutions ; it is placed in front of the axle and a roller-drag su

orts the fore-carriage when not attached to an implement. The wheels, hich drive and steer at the same time, are fitted with a special kind of ipping device, which projects through the rims and is kept in action or ojecting, by bolts each acting on two consecutive paddles. The frame rminates in front in an " écamoussure " bearing 4 horizontal superim-osed bearings, one of which will receive the gudgeon which must be tached to the front of any implement which the polyculteur will haul. s regards the 3-furrow brabant plough, the weight of the two sets of 3 odies must be quite the same, so that the plough can turn equally easily either direction ; the gudgeon, however, is not in the same plane as hat of the centre of gravity and is really between the latter and the anchions of the front bodies. Thus, when the driver reverses at the eadland, causing tipping and freeing the brabant, meanwhile turning the heel towards the land to be ploughed, the bodies turn over to the de of the stanchions ; turning with the reverse produces a couple which ccentuates the pivoting movement, and when the forward speed is eared up, the turn finishes and the plough slips into place itself as soon s the point of the first sock enters the ground. This is an unusual evice. M. Dubois has suggested the adaptation of a windlass for cable-loughing on the shuttle system, with a two-way plough hauled by two milar machines.

M. E. Lefebvre (Rouen, Seine-Inférieure) showed the Normania -furrow tipping plough, whose wheels, 1.40 m. in diameter and displac-d in height by 20 cm., receive the direct drive of a 20 H. P., 4-cylinder Ballot engine ; the reaction of the engine forces the plough bodies on to heir work ; on reversing, the plough is tipped over. There is only one speed, with a device for reversing the drive. The plough bodies can be egulated separately, so that they trip in properly. The machine, which eighs 2700 kg., can plough, using 3 bodies on each side, from 2 to 2.5 ectares a day, according to the resistance of the soil.

D. — Machines with moving working members.

MM. Eugène Bauche & Cie. (Chesnay, Seine-et-Oise) have made an important modification in their small motor cultivator ; the engine is now watercooled and provided with a radiator, so that the engine (Fig. 5) can run full out without fear of over-heating.

MM. Pétard & Préjean (Aubervilliers, Seine) have produced a " mixed " machine, called " cultivateur rotatif et vignoculteur " (Fig. 6) which can be driven by an injured person. A 2-wheeled axle, fitted with shafts for a horse and a driver's seat, carries a 4-8 H. P. engine wihch drives a horizontal shaft, whose height can be adjusted and which is provided with numerous long, curved tines. The speeds are changed by means of a handle and the tine are lifted by means of a crank, so that a man with injured legs could drive the machine ; the handle or crank can be replaced by a pedal to enable a one-armed man to use the machine. The machine is illustrated in Figure 6.

E. — Ploughing sets.

MM. J. Fillet & Cie. (Bordeaux) make small windlasses mounted on 3-wheeled frames, with drums that take 215 m. of cable 6 mm. in diameter, and driven by H. P. engines. The cable can be wound up at 3 speeds :— 60 90 and 110 m. per minute, with the engine running at full speed (1400 revolutions), the intermediate speeds being obtained by reducing the engine

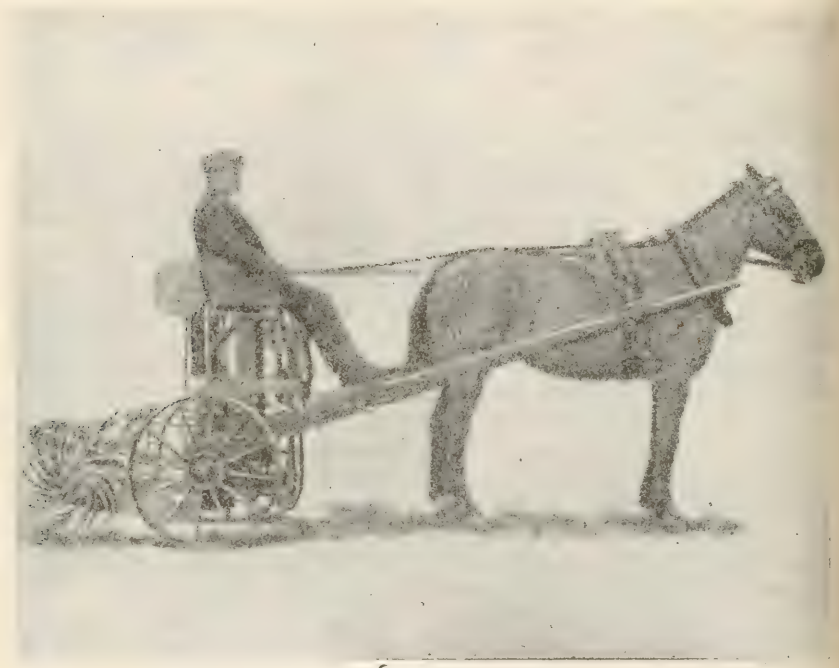

Fig. 6 — The Pétard & Préjean rotary cultivator.

Two similar windlass-waggons are used, to draw a tipping plough shuttle fashion. The windlasses are kept in position by an anchor spade attached to the front of the frame and also used to make to cable wind evenly. The engine is either a 4-cylinder Ballot or Panhard, or a 10 kilowatt electromotor of a type suitable for the current to be used.

F. — Various accessories.

The author concludes his article by describing a *dynamometer* specially made by M. G. Desprez (Neuilly-sur-Seine) for use in power farming. It consists of a flat spring, rolled up snail-wise and enclosed in a jointed, deformable frame. The tractive effort reduces the height of the frame,

mpressing the spring, and the movement is transmitted through a ck and a toothed pinion to a needle moving over a graduated dial ; a cond needle, loose on its axis and kept rubbing by a small spring, shows e maximum effort obtained. This compact and light dynamometer as tried by the author on a PEUGEOT chaintrack tractor and on a Feltz wing tractor ; the graduations are easily read and, although the limit r which the spring was made (1000 kg.) was more than passed, yet further adings taken, agreed with previous ones and the needle came back exactly zero. The author thinks that a simple and inexpensive dynamometer the necessary complement of any power farming machines on which can be used for, when it is possible to ascertain at any moment the ork required of a tractor, it will avoid overloading and many mistakes.

II. — The Editorial staff of the *Vie agricole et rurale* adds informat on supplied by certain makers regarding the machines they exhibited.

(1) PAVESI P4 "*Agrophile*" *tractor*. — Described above. Besides s use for ploughing, it can tow harvesters, drills, etc., and can do trans ort work on the road, replace locomotives, and drive threshers, presses, umps, etc. from a pulley. Costs little in labour, as one man is sufficient.

(2) PAVESI P4 *lorry-tractor*. — With 4-driving wheels ; it is a real *olonial lorry*, which may replace the horse, camel, and elephant in those egions still unprovided with roads, and thus bring about considerable aving compared with the means of locomotion now in use. In fact, can run fully loaded on roadless deserts and steppes, undisturbed by neven land, steep slopes and the narrowest curves. It can draw a road rain (Fig. 7).

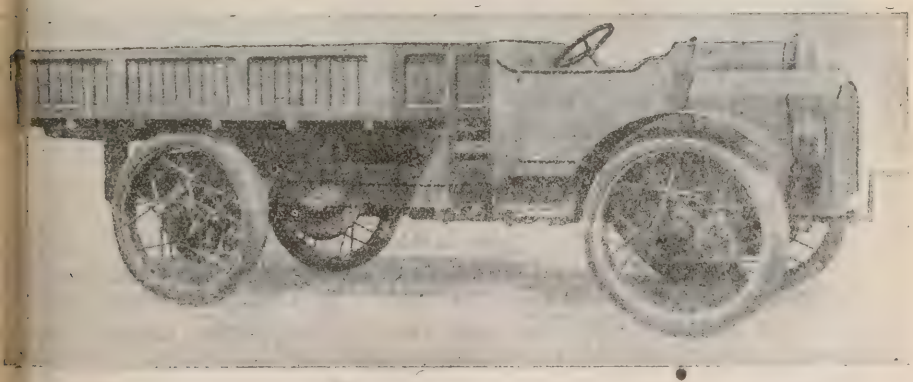

Fig. 7. — PAVESI lorry-tractor.

(3) PAVESI *trailers*. — The SOCIÉTÉ AUXILIAIRE AGRICOLE (Paris), which exhibited the Italian PAVESI tractor, makes trailers for this lorry ractor :— (*a*) 5000 kg. trailer ; (*b*) 3000 kg. trailer ; (*c*) agricultural railers (one model with steel springs and another without springs).

(4) *Agro fore-carriage tractor.* — This for-carriage tractor, which had already been shown at the spring trial held at Saint Germain (1), reappeared at Senlis with important additions and modifications. A reverse has been added, and the road speed diminished so as to obtain direct traction at a speed of 4.9 km. per hour. Soil-grip is obtained by fitting each of the wheels with two half-rings provided with special strake that enable the machine to run smoothly on the road, and do away with the lateral twists that strain the axle. The small breadth of the machine (96 cm.) allows it to be used among vines. It can haul a cultivator, harrow, mower, etc.

Fig. 8. — RENAULT tractor.

(5) *The 16 H. P. Happy Farmer tractor.* — The " Taureau " tractor of the Agricultural Co.

(6) RENAULT *farm tractor.* — This tractor (Fig. 8), which attracted much attention at Saint-Germain (1), has obtained a fresh success by ploughing 2 hectares 18 cm. deep with a 4 furrow plough in 5 ½ hours.

(7) *Tank Neverslip tractor.* — The machine shown at St. Germain was of 12-20 H. P., but that shown at Senlis was of 18-30 H. P. A chain-track tractor, combining the principles of the motor-car and the railway.

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(1) and (2) See *R.*, Oct.-Dec., 1919, nº 1222. (*Ed.*).

(8) TOURAND-LATIL *motor plough* (1). — Motor plough mounted on 4 wheels, weighing (with the plough) 3200 kg. ; 35 H. P. engine ; two forward speeds (3.5 and 5.5. km.) and a reverse (with a single loose pinion). The plough is lifted at the end of the furrow by a special shaft driven from the engine.

(9) " *Le Gaulois* " *tractor and plough.* — See Part I.

(10) BAUCHE *motor cultivatotor.* — See Part I.

(11) XAVIER CHARMES *pulveriser* (2).

Fig. 9. — « Messidor » plough hauted by a TOURAND-LATIL tractor.

(12) BAJAC *windlass-tractor.* — Well known. Now fitted with carburettor that enables either petrol or paraffin to be used as fuel.

(13) *Messidor reversible plough.* — The only machine that can plough without ridges when towed by any tractor. The driver of the tractor suffices to attend to the whole machine. All the advantages of the brabant plough are duplicated and amplified in this machine. Two-furrow and 3-furrow Messidor ploughs are made by R. M. PÉTARD.

(14) *T. P. rotary cultivator and vine cultivator.* — See Part I.

RURAL ECONOMICS

55 – **The Influence of Good Farm Organisation on Costs of Production.** — HANDSCHIN, W. F. (College of Agriculture, Urbana, Illinois). in the *Journal of Farm Economics*, Vol. I, No. 3, pp. 102-109. Lancaster, Pa., Oct., 1919.

It is not easy to separate definitely the influence of good farm organisation from the influence of good operations and other factors ; it is never-

theless possible to show how good organisation affects production, and to measure with reasonable accuracy its influence on costs. With this purpose in view farm organisation can be studied from the standpoint of three principal divisions : — 1) financial or economic organisation ; 2) physical organisation ; 3) productive organisation.

The financial or economic organisation of a farming business is concerned principally with the problem of determining the minimum size of the business that is well adapted to the type of farming to be carried on, and of working out the most profitable distribution of the investment in various items such as land, buildings, machinery and tools, horses and other livestock. It is evident that, if production is to be carried on most effectively, the various items of investment must be utilised to the fullest extent, consistent with the maximum returns for the farm business as a whole. The influence on the cost of production is very marked.

The investment in farm buildings in Illinois, exclusive of the farmer's residence, which is a personal item, often varies from $10 to $15 per acre for the same general types of farming carried on under similar conditions. Apparently these classes of farmers have adequate shelter for stock. Assuming a carrying charge of 15 % per annum for interest, depreciation, upkeep, taxes, and insurance, the total carrying charge per acre varies from $1.50 to $3.75 a year. That is, the difference in carrying charge, or the cost of production per acre, due to this one item alone is $2.25 per acre per year.

In the same way, in the case of machinery, exclusive of tractors, the carrying cost ranges from $5 to $10 per acre. Assuming a carrying cost ranging from 20 to 25 % (including interest, shelter, taxes, upkeep and depreciation), these differences in the investment of machinery per acre would mean a difference in carrying charge of from $1.00 to $1.25.

If the physical organisation of the farm is studied from the standpoint of its influence on production and costs, it is found to have a notable bearing on the problem. In working out the plan for the best physical organisation of a farm, the plan can be divided logically into two parts : — *a*) the organisation of the farm as a whole, including the location of the farmstead, and the general laying out of the field system ; *b*) the more detailed planning of the location and arrangement of yards, paddocks, lanes and buildings. In the first case, the importance of reducing to the minimum the distance between the farmstead and the fields should be remembered ; but the advantage of having the farmstead within easy reach of the public road should not be forgotten.

In planning the field systems for the major rotation : — 1) There should be as many fields of nearly equal size as possible, as there are years in the rotation.

2) Fields should be as large as practicable to save time doing farm work and reduce the cost of fencing.

3) Fields should be rectangular if possible, and about twice as long as they are wide.

Many farms could be improved in this respect. The University of

Minnesota reports that in the replanning of a 160 acre farm situated in Missouri the average distance from the farmstead to the fields was reduced from 70 to 24 rods, and the amount of inside fencing was reduced from 892 to 640 rods. Illustrations of this kind could be multiplied indefinitely.

The problem of physical organisation is relatively more important on farms producing livestock where the question of handling livestock with the minimum expenditure of man and horse labour presents opportunities for very important economies. All yards, paddocks, pastures, and lanes should be so laid out as to allow for easy moving of animals from one place to another about the farmstead or between farmstead and farm fields.

The location of barns, stables and feed storage should be so planned as to reduce the man and horse labour required to a minimum. Systematic study of these questions has now been begun; their aim is to diminish the cost of production through good reorganisation.

Important as the economies are which can be effected through the best financial and physical organisation of the farm, it is probable that on a large majority of farms even greater economies can be effected through the more scientific organisation of their productive enterprises.

In the organisation of the crop and animal enterprises with a view to establishing the most profitable and permanent systems of farming, a number of complex and inter-related factors must be taken into consideration owing to their influence on production and costs. The maintenance of the fertility of the soil, the most advantageous marketing of produce, the best utilisation of the man and horse labour used, the insurance against crop failures, price fluctuations, and other unfavourable conditions, these are the problems closely associated with the present system of agriculture, and the solution can only be looked for in a ready combination of these factors.

In the study of costs of production, the expense of maintaining fertility has been almost entirely overlooked. In working out this problem, the growing of leguminous crops offers the most economic source of nitrogen, and the rotation should include the proportion of leguminous crops necessary to maintain or increase nitrogen in the soil, and if the manure is carefully handled, from 60 to 70 % nitrogen, from 75 to 80 % phosphorus, and from 80 to 85 % of the potassium contained in the crops fed can be returned to the soil. In so far as the mineral elements in the soil are limiting factors in crop production, they should be added in such form and in such amounts as will contribute most to the profits of the entire farm business.

In organising the productive enterprises so as to provide the most advantageous market for all products, livestock plays an important part, because it is possible to market advantageously not only the salable portion of the crops grown, but also the unsalable and waste portions. This factor alone eliminates much waste and helps to increase profits, without increasing the cost of producing animals and animal products.

In practically all types of farming in the United States, man and horse

labour make up from 75 to 85 % of the total operating expenses. A good rotation of crops, with two or more kinds of livestock, make possible the most even distribution of labour throughout the year and this has a marked influence on production and costs. The variations found in Illinois in the cost of horse labour are responsible frequently for differences of from $1 to $4 per acre in the production of ordinary crops, such as maize, oats, wheat and hay. It is not easy to say how far these differences are due to good farm organisation or to other factors; but it is plain that they are mainly due to the more efficient organisation of the productive enterprises, i. e., the crop rotations and the systems of animal production followed.

The more even distribution of labour throughout the year, as a result of the better organisation of the crop and animal enterprises, makes it possible to find productive employment at the moment when the demand is greatest, There is, consequently, an increase in price and a better grade of labour can be secured.

By combining the growing of several crops well adapted to the region and marketing them with several classes of livestock, the largest measure of insurance is procured against crop failure, price fluctuations, and other unfavourable conditions. The flexibility obtained in the livestock enterprises by carrying at least one class of animal which can be reduced or increased. is worth noting. Swine, sheep and poultry represent illustrations of flexible animal enterprises, whilst the different classes of dairy cows and beef cows represent the more inflexible forms.

Efficient farming consists mainly in so adjusting the financial, physical and productive organisation of the farm so as to return the maximum profits for the entire business over a series of years. Each enterprise must be studied from the standpoint of its influence on the business as a whole.

356 – **Farm Management Problems in the United States.** — Bilings, G. A., in *Journal of Farm Economics*, Vol. I, No. 1, pp. 3-7. Lancaster, Pa., June, 1919.

The unusual demand for food products and the scarcity of farm labour since the war began, have given rise in the United States to conditions which demand greater concentration of effort on farm management problems. These problems affect the community, the state, and the country as a whole and are in a measure sociological, but since they bear a close relation to production and to the individual farm, the basic unit of production, they are of vital importance to the economic management of the farm.

There has been no period in the history of the United States when economic conditions have changed so rapidly, requiring the most careful thought concerning the organisation of farms of different types to meet present day needs, and the changes which may take place after the war ; the policy of price fixing of farm products and its bearing on profitable production as compared with the fundamental law of supply and demand ; the mobilisation of farm labour to produce the supply of food needed ; and many other important factors have combined to furnish entirely new problems.

The cost of producing milk in large dairy regions and the cost of producing wheat as the basis for fixing the minimum price of wheat to the farmers,

illustrates the kind of information which has more recently been demand ed. The request for such information shows conclusively that the results from the investigation of farm management problems by state and federal departments should be tabulated, summarised and held in readiness for such requests. Moreover this information should be put into such shape that opportunities may be given to the farmer to obtain suggestions for adjusting his system of farming to meet these changing conditions.

During the l ast ten years farmers have adjusted their business to meet slight changes in economic conditions. The ratio between food production and the increase in population has been quite constant.

The work in farm management has been therefore mainly to study the organisation of farms and the farm practice in agricultural regions, in order to discover the relationships between farm enterprises and to determine what factors have a direct bearing on net incomes. The influence of such studies should be to induce the farmer, whose farm is not producing profitably, to adopt those practices which will increase his income. This work has had a tendency to raise the average production and take care of the increase in population.

Increasing the Nation's Food Supply. — The situation in relation to the food supply has been not so much economic as nutritional, that is, it has been a question of systems of production to feed the people rather than systems arranged purely for the sake of gain. No more effective work can be continued than the presentation of facts calling attention to the relative value of foods produced on an acre, with suggestions in farm practice that will increase profitably, if possible, those products of greater nutritional value.

Relation of the Labour Supply to Food Production. — In view of the depletion of the country's food supply and the possibility of a continued demand for increased crop production, farm management men should devote special attention to methods of adjusting the farm plan to give maximum production with the greatest efficiency in the use of labour and machinery. The scarcity of skilled labour has been the principal limiting factor in production, and this factor will check the intensity of farming. The use of tractors in ploughing and the preparation of soil for sowing may enable the farmer to get his crops planted at the proper time, though possibily this may not be much of a factor in reducing costs. A saving of a man power will likewise result from using four, six or more horses with larger machinery. Any line of work that will demonstrate how production may be maintained with less manual labour is most important at this time, otherwise there is great danger of land which might be used for wheat or other food crops being seeded down and a more extensive type of farming adopted.

It is essential to have information concerning the amount of labour required for farm operations and its distribution. These data are fundamental in working out cropping systems, particularly in determining when and how much labour is required for each month in the season. It will show in advance what regular labour is necessary and indicate when extra help is needed. If it is impossible to obtain extra help at these times, it may be

possible to introduce some labour-saving machinery or the farmer may co-operate with neighbours in exchange for help. If this difficulty is anticipated and the amount of labour required for different operations is known, the difficulty may be obviated by readjusting the crop acreages and the introduction of supplementary crops, which will maintain a more uniform labour requirement. It is in the solution of problems such as these that farm management men can be most helpful.

The economy in conducting farm operations is also influenced by the location of farm buildings and the shape and arrangement of the fields. The arangement of farm areas, making larger and more uniformiy-sized fields which can be more easily handled in rotation, would simplify the handling of machinery, save much time, and reduce the cost of production. Such work would attract the attention of farmers and be appreciated by them.

Standards Needed in finding Cost of Production. — The importance of adopting, as far as possible, standards in methods and agreements as to the elements in production cost studies, has been demonstrated by the greatly increased interest in this subject due to price fixing. Many agencies have been at work on these studies during the past year and such results as have come to light vary greatly in method of presentation as well as the elements included in determining cost.

Sometimes, overhead or indirect costs are included, and at other times omitted, in spite of the fact that every farm must bear in labour cost alone a burden of indirect expense equal sometimes to one-third of the cost of all the labour performed. These same discrepancies exist as to other elements such as machine cost, supervision, building costs, etc.

Sometimes particular interests affecting the point of view, influence the interpretation of inter-relationships in production cost finding. One group insists that all feedable crops produced and fed should be charged to live stock at cost of production. On the other hand, many writers, including those of the experiment stations and the United States Department of Agriculture, believe that market value at the farm is the only safe practical and correct value to use. The subject of cost production presents greater difficulties in certain aspects than almost any other branch of accounting, because of the many interrelations between farm enterprises. For example certain equipment is used in preparing the ground, cultivation and sometimes harvesting of more than one crop. When land is prepared for oats or wheat, the land is also prepared for clover and timothy which follows. Likewise, in some regions, clover and timothy is seeded at the last cultivation of maize Maize, oats and wheat are sometimes combined with live stock production The raising of pure-bred cattle and milk production are very closely related and the costs would be hard to separate were it not for an established rule among farm accountants that in pure-bred stock production milk is a by-product and the cost of feed in animal production is not chargeable to milk.

Importance of Studying Farm Practice. — Crop yields and production per animal are important factors in profitable farming; therefore any practice

that will increase crop yields and production per animal will be not only of economic interest, but will increase the food supply. Experiment station results clearly point out methods for increasing production, but these conclusions may be confined to certain types of soil. Just as important results have been worked out by farmers under much more widely varying conditions, hence, the study of farm practice should be an important field of work.

Farm management surveys may help to analyse economic problems, but the story of how soils have been made productive through systems of rotation with clover, alfalfa, soya beans or other legumes, and the methods practised in the use of cover crops, manure, lime and fertilisers, will help to interpret the figures obtained from surveys. Farm management surveys provide a basis for the analysis of systems of farm organisation and the results from certain operations. Farm practice studies, on the other hand, will show the methods employed and why certain results are obtained. It gives additional information necessary to work out a complete farm plan. There is an unlimited field for work of this sort which will go far towards developing standards for farm operations.

Co-operative Investigations. — Progress in the study of economic problems will develop more rapidly, and the results of investigations will be applied more successfully by the most earnest co-operation between the United States Department of Agriculture and state agricultural institutions ; between the investigator or demonstrator and the farmer.

The state institution is restricted in territory, whilst the federal department can study regions which may include several states.

There is a great amount of data which have been obtained through surveys, and which would make an interesting field of study if these data could be assembled and correlated. Instead of dealing with a few hundred or less, there might be several thousand records, which, when assorted, would give much larger groups and a basis for more accurate conclusions. It would give an opportunity for the study of selected types of farming, the profitableness of different combinations of enterprises. and of many other problems hitherto impossible.

357 – **Important Factors in the Cost of Producing Wheat.** — Boss, Andrew (University Farm, St. Paul Min.), in *Journal of Farm Economics*, Vol. I, No. 3, pp. 85-89. Lancaster, Pa., October, 1919.

For something over two years the importance of wheat production has been emphasised and kept before the world, first by agitation for a guaranteed price for wheat during the war and second by more or less serious attempts to determine the cost of producing wheat.

It is, therefore, important to know the factors of cost in wheat production and to find out how costs can be reduced or eliminated.

The factors of cost in present-time wheat production in the spring wheat growing section of America may be classified in the order of importance as follows : — Labour (man and horse), land, seed, machinery, threshing costs, general expenses and cost of twine. Fertilizer cost or values consumed is

just as legitimately a cost as any of the preceding items, but no one has as yet devised a satisfactory basis for determining what this cost is. No charge is commonly made, therefore, for soil fertility consumed in producing a wheat crop except where commercial fertilisers or manures have been purchased for cash.

Labour costs. — The cost for man and horse labour constitutes the largest item of cost in wheat production. It was found to be 41.4 per cent. of the total cost in Minnesota during the years 1913-1917. With increasing wages for man labour and much higher feed cost for horse labour than prevailed during that period, the labour cost now assumes an even greater proportion of the total. The opportunity for reducing the man labour cost lies in efficient management. The average hours of man labour required in Minnesota were found to be 12.3 and of horse labour 29.9. Some farmers are able to reduce the amount to 10 hours or less of man labour and 25 hours of horse labour, by the use of large implements and effective methods. The cost of producing an acre of wheat would be, therefore, considerably less than the average. The rate paid for man labour is a factor of importance in the aggregate cost of an acre of wheat, but it is little subject to variation during the season. The rate of horse labour, however, may be controlled to a considerable extent by the kinds and amounts of foods fed and especially by the number of hours of labour performed annually per horse.

The land factor. — Land is one of the largest factors in wheat production. Not all land is suited to wheat production. Climate also affects the growth and influences greatly the yield and quality of the wheat and ultimately the cost of producing it. Land that will grow wheat and that is favourably located as to climate is limited and is becoming increasingly more expensive.

It is much more difficult to grow wheat profitably on $ 200 land than on $ 100 land. It has been estimated that to secure the same percentage of profit on investment on $ 100 land as on $ 25 land, a yield more than 4 times as great must be obtained. The charge for the use of land may be computed from one of two bases. It may be charged at rental value where cash rent is paid or the rental value can be otherwise determined. Or the charge may be made up of the items of cost, which are interest of the investment in land, taxes, upkeep of drains, fences and other land improvements. Where the values are affected by proximity to a large city or market with a strong demand for town lots or where values are greatly affected by speculation, as is now the case in the north central area, the rental value is perhaps the safest basis.

In normal times when values fluctuate less widely, the interest on investment basis is quite satisfactory. In determining the interest charge prevailing, prices of land exclusive of buildings should be used and interest figured at the rate at which money may be borrowed on well-secured farm loans.

In cost of production studies in Minnesota (1913-1917), the cost for the use of land was calculated to be $ 4.60 an acre or 28.2 per cent. of the total cost. Land values have since risen and present costs are much larger. There is no way to reduce this cost per acre in wheat production except to

grow wheat on cheaper land. The bushel cost could of course be reduced by increasing the yield, provided the increase can be secured without corresponding increase in other expenses (1).

Seed cost. — The seed cost of wheat is determined by the quality and quantity used and the market value. The seed cost in Minnesota, from 1913 to 1917, was 11.4 % of the total cost of growing an acre of wheat.

Machinery cost. — Machinery plays a large part in wheat production. In fact it is because the wheat crop can be so well handled by machinery that it is so popular with farmers. It is difficult to determine accurately the cost for machinery for a specific crop where so much of the machinery is purchased and used for all crops in common.

The charge for the use of machinery is made up of depreciation, interest on investment, repairs and oils, labour for repairs and care of machinery.

Depreciation may be roughly calculated at 10 per cent. per year though in studies made in Minnesota, the record depreciation over a long period of years was found to be only 7.3 per cent. There is a wide difference in rate of depreciation for different machines and also on different farms.

In order to charge machinery values correctly it is necessary to determine the acre cost of each machine and distribute it to the various crops concerned. The cost for machinery has greatly increased during the past two or three years owing to the increased price of new machines, the increased cost of labour and repairs, and other expenses of maintenance.

This increase is estimated to be 60 to 75 per cent. The cost for machinery in producing wheat in Minnesota, 1913-1917, was found to be 8.1 per cent. of the total cost.

Cash Threshing Cost, General Expense and Twine. — The minor costs in wheat growing are composed of the cash cost for threshing which is about 5.2 per cent. of the total, general expenses 4.3 per cent. and cost of twine for binding 1.3 per cent.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

358 – **Contribution to the Chemico-biological Study of Micro-organisms Injurious to Winemaking.** — GARINO CANINA, E. (R. Stazione enologica di Asti), in *Rivista di Ampelografia*, Year I, No. 1, pp. 2-6, bibliography of 10 works, Leghorn, Jan., 1920.

On grapes spoilt by parasites, especially in wet years, besides the ordinary ellipsoid saccharomycetes of wine-producing countries, there are very numerous micro-organisms, which may directly influence the regular progress of alcoholic fermentation. In the natural microflora of the grape, the genus *Botrytis*, *Penicillium*, *Mucor*, *Aspergillus* predominate among the moulds, and *Torula* sp., *Saccharomyces apiculatus*, feeble producers of alcohol, or quite incapable of causing fermentation in grape sugar among imperfect fungi; the action of all these micro-organisms is denoted by the production of unpleasant odours and flavours which be most injurious to

(1) See *Bulletin* 179, *Minn. Agr. Expt. Station.*

the quality of the wine. The genera *Pichia* and *Willia*, characteristic producers of ethers, may also be found.

Generally the micro-organisms of the natural flora of the vintage are active in the combustion of sugars, acids, and nitrogenous substances, and they may secrete enzymes that hinder normal alcoholic fermentation and may produce diseases.

With the help of material obtained from the Zymological Section of the Royal Wine-making Station at Asti, and other strains from the microbiological laboratory of Professor E. KAYSER of Paris, the author has investigated the action of some of these micro-organisms on the groups of principal acids which are normally found in grape must.

Cultures were sown in the must of the "favorita" grape, previously sterilised, kept at a temperature of 24° C. for about fifty days, then analysed. The analytical data obtained for each test are summed up in the following table: —

			Saccharomyces ellipsoideus	*Willia anomala*	*Pichia membranaefaciens*	*Dematium pullulans*	*Penicillium glaucum*	*Botrytis cinerea*
Acidity	free in cc.	N/1 ‰	104.0	103.0	108.0	80.0	59.0	105
	combined in cc.	» »	25.0	27.0	24.0	23.0	22.0	24.0
	volatile in cc.	» »	11.3	22.0	17.0	3.0	3.3	18.5
	fixed in cc.	» »	96.5	81.0	90.2	77.0	56.7	87.0
Acid	tartaric total in cc.	N/1 ‰	50.0	42.0	49.0	49.5	49.5	45.5
	lactic total in cc.	» »	6.75	31.3	14.5	10.5	23.3	21.0
	tannic total in cc,	» »	traces	traces	traces	—	0.0	—
	malic total in cci	» »	61.0	35.0	50.7	46.0	6.0	44
Ethers	totals in gm.	N/1 ‰	0.650	1.850	1.540	—	—	—
	volatile, in gm.	» »	0.300	0.125	0.210	—	—	—
Reducing sugars in gm		» »	3.00	187.0	206.0	193.0	168.0	20.30
Rotary power $[\alpha]D\,20$			— 0.24	— 6.92	— 8.80	— 7.76	— 7.20	— 7.44
Dextrose, in gm.		» »	1.20	95.5	103.0	97.5	72.4	102
Levulose, in gm.		» »	1.80	91.5	103.0	95.5	96.6	101

These results lead to the following conclusions:—

Pichia membranaefaciens and *Willia anomala* did not sensibly diminish the total acidity, because of the considerable increase of volatile acidity and lactic acid, although a considerable quantity of malic acid was attacked. The total ethers were present in more than normal proportions: dextrose and levulose were consumed in approximately the same degree.

The same may be said of *Botrytis cinerea.*

Dematium pullulans and *Penicillium glaucum* much diminished the total acidity without producing an equivalent quantity of volatile substances; *Penicillium* showed itself the most active acid destroyer; de-aci

dification was produced almost entirely at the expense of malic acid, of which $^{9}/_{10}$ disappeared. The sugars were also been attacked, dextrose with special intensity.

In an experiment tried with must to which 0.179 of sulphurous anhydride per litre had been added, *Saccharomyces ellipsoideus* caused regular fermentation, with a delay of 48 hours ; the other previously mentioned micro-organisms did not develop, and 25 days after they were sown the fermentative activity was practically nil.

359 – **On the " Casse bleue " of Wines.** — CARLES, P., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXIX, No. 26, pp. 1422-1423. Paris, Dec. 29, 1919.

In continuation of the communication made by M. PIÉDALLU to the French Academy of Sciences on Dec. 7, 1919 on the " casse bleue " of wines (1), the author communicates the following note:

This " casse " has already been known for a long time. It was specially studied in 1900 by M. M. LAGATU, L. ROOS, and BOUFFARD at Montpellier. These writers have differentiated it from the " casse brune " of red wines called " casse diastasique ".

M. PIÉDALLU writes that, practically, to prevent " casse " in wines rich in iron, it suffices to keep them in a reducing medium, by simply drawing them off into well sulphured casks, but that it is always preferable to avoid the use of receptacles of unprotected iron for manipulating or preserving the wine. The observations of other writers lead to a different conclusion.

The " casse ferrique " is not controlled by sulphurous anhydride, and if it were possible to keep wines protected from the air by sulphurous anhydride or some other gas, the practical result would not be attained, since all wine, before it is drunk, must be handled, and must inevitably come in contact with the air.

The true treatment of this " casse " consists in adding to the wine an organic acid such as tartaric or citric acid. The latter is more generally used ; with the iron it forms a compound on which tannin, and consequently colouring matters, have little effect. The quantities of tartaric or citric acid vary according to the intensity of the disease and the procedure is to make a preliminary test by commencing, for example, with 50 gm. of tartaric acid per hectolitre and increasing progressively up to 150 gm. or 200 gm. if necessary in certain wines which, like that of Jacquez, are raw materials. Citric acid is used in smaller quantities because it has a stronger action than tartaric acid.

The action of sulphurous anhydride in preventing the " casse ferrique " has no practical effect. This was first shown by BOUFFARD, Professor of Oenology at the National College of Agriculture at Montpellier, who first investigated the " casses " and recommended sulphurous anhydride as a remedy for " casse brune " or " casse diastasique ".

(1) See *R.*, Feb., 1920, No. 250. (*Ed.*)

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

360 – **Quantities of Butter, Cheese and Condensed Milk Made in Factories in the Unite States During the War.** — PIRTLE, T. R. (Statistician for the U. S. Dairy Division), i *Hoards Dairyman*, Vol. LVII, No. 20, p. 1000, 1 diagr. Fort Atkinson, June 6, 191

Making use of (*a*) the census results of 1909, (*b*) those of the manu facturing census of 1914, (*c*) the reports of production of factories issue by the Bureau of Markets for 1916, 1917 and 1918, the author gives, i the subjoined Table, a summary of the quantities of butter, cheese an condensed milk (including evaporated milk) prepared in factories (exclud ing home made products) in the United States during the last ten years

From these results it appears that great progress has been made i the dairy industry during these ten years and that also the condensed mil industry has almost doubled during the war; in 1918, a greater amount c milk was used in the condensed milk factories than was used for cheese

Quantities of butter, cheese and condensed milk made in factories in the United States from 1909 *to* 1918.

Years	Butter (*Pounds*)	Cheese (*Pounds*)	Condensed Milk (*Pounds*)
1909	627 145 865	311 1[illegible]5 730	495 197 84
1914	786 003 489	377 573 409	875 507 43
1916	760 030 573	314 716 739	997 835 11
1917	743 895 068	372 540 203	1 353 605 59
1918	793 289 301	352 621 615	1 675 477 36

361 – **Experimental Study of Electro-Purification of Milk.** — ANDERSON, A. K. ar FINKELSTEIN, R., in *The Journal of Dairy Science*, Vol. II, No. 5, pp. 374-406, 2 fi Bibliography of 8 works. Baltimore, Sept., 1919.

The principle of the process of electric purification of milk (electr pure process) consists in heating the milk by means of a high voltage ele tric current, and then cooling it.

The apparatus consists of a receptacle for the milk, of a heater in whic the milk is heated to 40° C. by steam, of a supply tank for the electric p rifier, of a hot milk tank acting as reservoir to the cooler and of a coole

The electro-pure machine itself consists of several units, varying number according to the quantity of milk to be treated. Each unit is cor posed of a series of 5 porcelain cups arranged as in the accompanyi figure. The milk is distributed to the cups by a tap leading from a bo shaped distributing tank. The first cup of each series has about twice t capacity of the other cups. The cups of each series are arranged so that t milk entering the first cup will drain into the second cup, which is plac slightly forward and below the first; when the second cup is filled, the mi overflows by a lip into the third cup, and so on to the last cup of the seri In each of the smaller cups, which have a capacity of about 200 cc. placed an electrode in the form of an insulated rod terminating in copper disc. This disc is about the size of the inside of the cup and when

place is very near the bottom of the cup. When the machine is in operation the circuit is completed by the stream of milk, which by its electrical resistance is raised from 40° C. (the temperature on its entrance into the machine) to 70° C. (the temperature when it passes out). An alternating current is used In the machine illustrated in the accompanying figure the voltage is 2300, the amperage is 14 and the frequency is 25. The three phase system is used.

Electrical milk purifier.

With electric current costing 5 cents per kilowatt-hour. the cost of working is $2.74 per hour for a machine with 6 units, which treats 5000 pounds of milk per hour, exclusive of the cost of the preliminary heating to 40° C.

As the literature on the subject of the efficiency of electrical treatment of milk furnishes but few data, the authors have dealt with the subject by making a series of careful experiments, the results of which lead to the following conclusions: —

The "Electro-pure" process produces a very satisfactory reduction in the total number of bacteria contained in good raw milk and a satisfactory reduction in the bacteria contained in poor raw milk, and at the same

time it destroys effectively nearly all lactose fermenting, endopositive organisms contained in raw milk.

Milk issuing from the different units of the " Electro-pure " machine contains a fairly uniform number of bacteria.

Electro-treated milk kept at 5-10° C. keeps well for about 5 days. At ordinary temperatures it shows no change in 24 hours but sours normally in 48 hours.

The destruction of bacteria in the electric purifier is due to the heat produced rather than to the electric current itself. The electric purifier furnishes a means of producing a very sudden high temperature for a short time.

Heating to 70° C. by means of the electric purifier causes: — Little or no precipitation of albumin ; no modification in the quantity of cream which separates on standing ; apparently no destruction of the peroxidase, but a weakening in the reductase ; no modification in the feeding value of the milk. On the other hand, such treatment increases sensibly the time required for coagulation by rennin. In the experimental plant which was used by the authors, the electric purifier, after long use, was not entirely satisfactory; modifications in construction are required before the machine can be considered a commercial success.

362 – **Study of Babcock Test for Butterfat in Milk.** — BAILEY, D. E., in the *Journal of Dairy Science*, Vol. II, No. 5, pp. 331-373, Bibliography of 28 Works. Baltimore, N. D, September, 1910.

The Babcock test for butterfat in milk is used to a considerable and increasing extent as a basis of payment for milk to be used as such, as well as for condensing and cheese making. It is also used in determining the milk production of individual cows, and hence is an important means of determining their value.

In view of the importance of the test, the author has undertaken experimental work to determine the accuracy of the test as carried out at present, and to study the influence of some factors upon it. The results are summarised as follows :—

1. The Babcock test for milk when read from the top of the upper meniscus to the bottom of the lower meniscus gave results which were higher than those obtained by the gravimetric (Roese-Gottlieb) method. On the average of 190 comparisons, the difference amounted to 0.060 %.

2) There was a considerable variation in the readings of the same sample by a few individuals ; this was largely due to reading at different points on the upper meniscus, and it is believed that the higher readings were made at the top of the upper meniscus.

3. The breed of the cows and the stage of lactation had a small influence on the excess of the Babcock results over the gravimetric determinations. This influence is due in part to the variation in the size of the fat globules and in part to the variation in the percentage of fat present in the sample tested.

4. The amount of fat left in the liquid below the fat column is quite variable and on the average equalled 0.13 % expressed as readings on the neck of the test bottles.

5. There were impurities in the fat column that on the average amounted to 0.78 % of the readings.

6. The Babcock test would read about 0.11 % lower, depending somewhat on the per cent. of fat in the sample, if the meniscuses were not included in the reading. The value of the gain to readings due to the meniscuses more than offsets this low reading, which is in agreement with the first conclusion.

363 – **Utilisation of Dairy By-products.** — KELLY E. (Dairy Division, U S. Department af Agriculture), in *Journal of Dairy Science*, Vol. II, No. 1, pp. 46-49. Baltimore, Jan. 1919

Waste of matter may be caused (1) mechanically (actual loss), or (2) by not using it in the best possible manner (partial loss). The dairy industry unfortunately too often wastes in both ways. Only the surplus skim milk which cannot be used for human consumption, should be fed to animals and ought to be much more employed than it is at present: 100 pounds of skim milk will produce 15 to 19 pounds of "cottage cheese" (1), whereas fed with maize to pigs it would produce only 6 pounds of live weight or 4.8 pounds of dressed pork. There is, therefore, in the former case production of about 7 times as much protein and energy as in the latter. Moreover, in making "cottage cheese" 80 to 85 pounds of whey is recovered from 100 pounds of skim milk, and this has half the food value of skim milk for feeding pigs.

Skim milk and buttermilk can be used in that state as beverages or in cooking. One pound of "cottage cheese" contains as much protein as 1 to 1 ½ lb., of meat, and can be used in a number of ways in cook- This is one of the best ways of using skim milk because "cottage cheese" is easily and simply made and it can be consumed in large quantities. But skim milk can also be used for making condensed skim milk and skim milk powder. Whey from cheese factories contains on the average 0.2 % of fat which can be recovered and used in the manufacture of whey butter. Lactose, casein, etc., can also be made from whey.

All the by-products of the dairy industry, if they are to be used without risk for human consumption (or indeed as animal food), should be pasteurised.

364 – **Observations on the Washing of Milk Cans.** — WEBSTER, R. O. (Bureau of Chemistry, U. S. Department of Agriculture), in *Journal of Dairy Science*, Vol. II, No. 1, pp. 50-59. Baltimore, Jan. 1919.

An account of data collected by the Bureau of Chemistry of the U. S. Department of Agriculture (under the Food and Drugs Act) relating to the milk supply of one of the large cities of the central western part of the United States.

The author notes the methods and equipment used by 32 milk dealers in washing the milk cans: 8 of them washed the cans by pouring the water from one can to another and 22 washed the cans in a tank; only one used hot water and 2 clean cold water, while 28 used dirty water. In 23

(1) See *R.*, Jan., 1920, No. 125. (*Ed.*)

dairies the cans were steamed, but in no case was the treatment effective, so that no dairy washed the cans in a satisfactory manner ; nevertheless 3 dairies possessed what is considered to be the complete equipment : — tank with mechanical brush, rinsing tank, steam jet, air blast.

Examination of the physical and bacteriological condition of 184 empty milk cans returned from the city dairy to the country dairy, made during June and July, showed that 14 cans had a sour odour and 83 a foul odour which indicated bacterial activity in these 97 milk cans. More than 21 % of the cans, if used without further rinsing, would have contaminated the milk with from 500 000 to 4 332 000 bacteria per cc. of milk ; milk produced in distinctly insanitary conditions rarely contains more than 20 000 organisms per cc.

To prevent this fouling of the cans they should be rapidly dried immediately after washing ; this can be done by exposing the milk cans to a blast of dry air ; 30 seconds exposure to such a blast is sufficient to produce a great improvement.

The author gives the following rules for washing milk cans properly : Avoid the use of disinfectants ; they are unnecessary and may remain in the cans in sufficient quantity to be found in the milk, which would render the producer liable to legal penalties.

For the proper washing of the cans a tank with clean hot water is necessary ; washing powder ; thorough brushing by hand or by machine ; rinsing in clean water ; steaming for at least 10 seconds ; drying in a blast of dry, hot air of sufficient volume to dry the can completely in 10 to 30 seconds. The lids should be cleaned in the same way. As soon as they are washed and dried the lids should be put on to close the cans and prevent their being soiled. Milk cans cleaned in this way remain clean indefinitely and even in the hottest weather there is no opportunity for bacterial activity.

365 - **Composition and Identification of Meat Extracts.** — Emery, J. A. and Heuley, R. R., in *Journal of Agricultural Research*, Vol. XVII, No. 1, pp. 1-17. Washington, Apr. 15, 1919.

The Bureau of Animal Industry asked the authors to carry out experiments with the object of obtaining data regarding the differences in composition of extracts of meat prepared from : — Muscle tissue, liver, spleen, heart, cured cooked meat, cured meat soak-water, and bones, all of which have been used in recent years in the preparation of meat extracts.

The extracts used in the authors' investigations were prepared partly in a large commercial establishment in the ordinary way, and partly in the laboratory, in much smaller quantities, but as far as possible by means of methods used commercially ; these latter extracts did not differ from the former either in physical appearance or in organoleptic properties.

The methods used in the analyses were essentially those of Street (described in Thirteenth Report on Food Products for 1908, Meat Extracts and Meat Preparations, in *Connecticut Agricultural Experiment Sta-*

tion Report 1907-1908, pp. 606-672). The authors determined, in a 10 % solution of solid extract or a 20 % solution of liquid extract: — water, ash, sodium chloride, total phosphoric and, inorganic phosphoric acid, total nitrogen, soluble nitrogen, coagulable nitrogen, ammoniacal nitrogen, nitrogen preicipitated by zinc sulphate, nitrogen precipitated by tannic-acid-salt solution, " meat-base " nitrogen (obtained by subtracting from the total nitrogen the sum of coagulable nitrogen + insoluble nitrogen + ammoniacal nitrogen + nitrogen precipitated by the tannic-acid-salt solution), nitrogen due to peptone-like bodies, non-nitrogenous organic matter, purins, creatinin, creatin, and nitrates. A series of Tables show the results in detail as well as some general averages, indicated in the Table below. The quantitative results show the following characteristic differences which depend on the nature of the extract: —

The liver extracts show: — A low percentage both of total nitrogen and of " meat-base " nitrogen ; a low ratio of inorganic phosphorus to total phosphorus ; a very low percentage of total creatinin ; generally a very high percentage of non-nitrogenous organic matter.

The spleen extracts show: — A high percentage of total nitrogen ; a low percentage of " meat base " nitrogen ; a very low percentage of creatinin. The ratio between inorganic phosphorus and total phosphorus is lower than in all other extracts except that of liver.

Extract of	Non-nitrogenous matter	Total nitrogen	Nitrogen in			Creatin + creatinin	Ratio between creatin + creatinin and nitrogen
			Zinc sulphate precipitate	Tannic-acid-salt precipitate	« Meat base		
Muscle, bones, liquors (soaked and cooked)	22.23	9.81	15.90	42.63	50.32	7.25	0.732
Heart	31.65	8.89	8.89	14 17	35.33	7.06	0.796
Spleen (prepared in laboratory)	24.34	9.68	24.76	52.10	38.30	2.40	0.248
Spleen (commercially prepared)		9.94				0.27	0.031
Liver (prepared in laboratory)	41.22	6.21	21.10	55.32	39.26	2.31	0.367
Liver (commercially prepared)		7.33				0 36	0.048

The heart extracts have a low percentage of total nitrogen compared with the muscle extracts, but much higher than that of liver extracts. They contain a considerable amount of non-nitrogenous organic matter and are next to liver extracts in that respect. Heart extracts differ from liver and spleen extracts in their percentages of total creatinin and " meat-base " nitrogen ; in heart extracts the latter forms at least 50 % of the total nitrogen.

The extracts of soaked and cooked liquor of pickled and cured meat are easily identified by the invariable presence of nitrates. The quantity of total phosphorus present in these extracts is very small. In other respects cured meat extracts resemble true meat extracts. Pickled meat extracts contain rather less creatinin than true meat extracts.

Muscle extracts have a high percentage of total nitrogen, " meat-base ", nitrogen and total creatinin ; they also have a high ratio between inorganic phosphorus and total phosphorus.

The bone extracts prepared commercially and the extract prepared from soak-water resemble muscle extracts.

There are also marked differences in the physical properties, colour, texture and " shortness " (an extract is termed " short " when it quickly and easily breaks on testing its elasticity). Liver extracts are very dark brown, their solution in water is dark red with a trace of fluorescence, and they are gummy. Spleen extracts and bone extracts are light chocolate to light yellow-brown in colour. The other extracts are lighter in colour than liver extract but darker than spleen extract; they are usually very " short ". Their solutions are dark but not fluorescent.

In addition to quantitative differences there are qualitative differences, which the authors have used as bases for identification tests for extracts of liver and spleen, either pure or in the absence of any considerable proportion of true meat extracts. These tests include: — The acetic acid test recommended by R. M. CHAPIN for distinguishing spleen extract by means of the abundant yellowish-white precipitate which is formed ; MOLISCH's test, which shows the presence of liver extract ; testing for copper in the ash, which if present indicates liver extract. The presence of copper is also shown by greenish colour of the ash.

CONCLUSION. — An extract can be completely identified by means of the following determinations: — Total solids, Ash, Sodium chloride, Total phosphoric acid, Inorganic phosphoric acid, Total nitrogen " Meat-base " nitrogen, Pre-formed creatinin, Creatin, MOLISCH's, test, Acetic acid test, Test for nitrates, Test for copper in the ash.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

366 – **Modification in the Sulphate of Iron Treatment for Controlling Chlorosis of Woody Plants.** — ARNAUD, G., in *Revue de Viticulture*, Year XXVI, Vol. LI, No. 1325, pp. 325-330, figs. 2, Paris, Nov. 20, 1919.

Results of experiments carried out in May-June and at the end of September in the Jardin de la Station de Pathologie végétale in Paris, on pear trees and Carolina poplars attacked by chlorosis. These were the only plants attacked by chlorosis available to the author; but he is of opinion that the results obtained by him are applicable to vines similarly attacked.

The suggested method is as follows:— Holes 1.5 cm. to 2 cm. deep are made in the trunk or large branches with a punch; by means of a syringe the holes are filled with a paste made by mixing 35 to 40 gm. of finely powdered sulphate of iron with 20 gm. of olive oil.

The treatment, made preferably in spring, only acts on those parts of the plant which are above the hole.

The treatment in question has the following undoubted advantages over the treatment formerly used, which consisted in placing crystals of sulphate of iron in the holes :— Certainty in effect, at least on the trees experimented with (pear, Carolina poplar), rapidity of action (the trees became green again in a marked degree in a week), and persistency of greenness; moreover, the treatment is very quickly done and economises sulphate of iron, as the syringe fills the holes almost without any waste. However, the method described has disadvantages which are absent from the method of painting freshly cut surfaces with a 20 to 30 % solution of sulphate of iron. The chief drawback appears to be the weakening of the trunk and branches in which the holes are made, especially in the case of young plants not provided with props. Also the addition of oil increases the cost of the treatment; but as inferior olive oil and various vegetable oils would probably be just as effective and the quantity used is small the cost of the treatment should not be much.

367 – **Diseases of the Tomato and the Strawberry New to South Australia.** — Osborn, T. G. B. in *The Journal of the Department of Agriculture of South Australia*, Vol. XXIII, No. 5, pp. 437. Adelaide, Dec., 1919.

In November, 1919, the author was informed of two serious diseases, attacking the tomato and strawberry plant respectively, not previously known in South Australia. There are reasons to believe that the two diseases were in existence before then, but had not attracted much attention. In 1919, they were particularly serious in some districts of the State, causing considerable havoc on certain farms.

In the case of the tomato, the first sign of change is the development of irregular brownish black blotches on the margin of the leaves; similar blotches may appear also on the petioles and on the young stems At the end of some days, the whole plant withers, and frequently dies.

The pathogenic agent not being known, it is not possible at present to combat the disease. It was recorded in Victoria two or three years ago, and from 1918-19, serious loss was incurred.

With regard to the strawberry plant, observations in the Hill district show that apparently healthy plants fade in the space of some hours when the weather is warm; although it is unusual for a plant to die at once during the first season in which it is attacked, it is hindered from regular development, and does not give any crop.

The diseased plants have their young roots darkened. It is believed that the change is due to a soil fungus. Up to the present, this disease has not been investigated.

The disease under discussion can be propagated by planting stolons taken from infected plants. Healthy plants put into fields formerly filled with diseased plants are duly infected. It seems also probable that the disease can be spread from an infected field to an uninfected field by drainage and the carriage from one point to another of infected soil clinging to workmen's boots or to agricultural tools.

The two diseases are being studied by the State Department of Agriculture.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

RESISTANT PLANTS

368 – **Disease Resisting Potatoes, Obtained in France.** — See No. 314 of this *Review*.

MEANS OF PREVENTION AND CONTROL

369 – **Weather Forecasts at the Station of Agricultural Meteorology at Montpellier in Relation to Control of Mildew and Other Diseases of the Vine.** — Ferrouillat, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, 36 No. Nov. 26 1919, pp. 919-925. Paris, 1919.

After a hard frost, which on March 26, 1898 in the Department of Hérault alone, damaged the vines to the extent of about 3 million hectolitres of wine, in a few hours, M. Houdaille, at that time Professor of physics and meteorology at the National College of Agriculture at Mont-

pellier, organised a Service of meteorological and agricultural inquiry, at the request of the Central Society of Agriculture at Hérault. M. RAVAZ, who then was Director of the Research Station for viticulture, undertook to furnish information regarding vineyards. From the following April, the College of Agriculture published, every morning, a Bulletin of information which was posted at Montpellier and at Béziers, the two principal vine-growing centres of the district.

The weather forecast was based on observations of the central meteorological Bureau of France, and especially on those made at the Mont-Aigoual Observatory, which enabled M. HOUDAILLE to forecast, fairly accurately, 48 hours in advance, the temperature, wind and rain at Montpellier.

The notices related particularly to forecasting frosts and the expediency of measures to be taken against fungoid diseases and insects injurious to the vine.

The Service was quickly extended and the Bulletin was brought to the notice of interested parties by means of a daily telegram posted at the town-halls of subscribing communes, and by means of notes inserted in the local press.

The results obtained by the meteorological Station of the College of Montpellier impressed the public authorities and led to the creation, in the Ministry of Agriculture, of the Service of agricultural meteorology.

The College meteorological Station was transformed into the local Station of agricultural meteorology and was installed on the Bel-Air, estate 3 km. from the town of Montpellier and about 1.5 km. from the Agricultural College.

To complete the meteorological information furnished by the local meteorological Station, M. RAVAZ organised 32 small meteorological outposts in the area assigned, recording maximum and minimum temperatures, temperatures during rain, the date, hour and amount of rainfall, the development of diseases, the appearance of insects, etc.

These outposts work as follows:—

(1) Every time rain falls the person in charge at the outpost sends the meteorological Station a postcard stating the amount of the rainfall, the temperature during the rain, the duration and time of the rainfall.

(2) In addition, every Monday, each outpost sends an abstract of its meteorological and biological observations.

(3) All this information is carefully checked on arrival at the Station, and is then methodically classified and entered in a tabular statement; the meteorological observations are also recorded as graphs.

It is thus possible very quickly to get a clear idea of the past and present meteorological and biological conditions of the area served by each outpost.

With the help of all these data, the Director of the Station issuing notices is in a position to predict the course of diseases of the vine and to give suitable instructions. The forecasting of attacks and invasions of

mildew, which, in the south, is the disease most feared, is based on the following principles:— The development of mildew depends on two essential factors, namely, temperature and moisture. It comprises 3 stages:—

(1) The germination and penetration into the plant of active germs, (attack).

(2) The development of the parasite in the invaded tissues, (incubation).

(3) The appearance on the outside of wounds or spots, some sterile (oil-stains), some fertile (efflorescences) (invasion).

For the attack live germs, atmospheric moisture (from rain, dew, and mist remaining for a certain time on the herbaceous organs), and suitable temperature are needed.

The presence of germs is easily detected. When this is ascertained, the attack only depends on the temperature and the persistence of moisture required for the germination of the spores.

Except at the commencement of growth, when a sufficiently high temperature is sometimes lacking, and during the summer, when rainfall is almost immediately evaporated, it may be said that any rain in the growing season starts an attack.

The three stages, which represent the complete evolution of a summer generation of the parasite, have a constant duration, with the vines in full growth in the south of France and under the ordinary conditions of cultivation; this period lasts 7 days. Its constancy is remarkable and this fact makes it possible to predict and announce 7 days in advance the date of appearance of each invasion.

By treating the vines so that they are covered with copper at the time when the attack is about to commence (which is known 7 days before), they are safe for several days from attack by the germs.

There is, therefore, advantage in limiting the treatment to the time when it is really necessary, which produces a considerable saving of fungicide and labour, and obtains the best possible result by applying the fungicide at the precise moment when the effect of the treatment will be greatest.

The practical results obtained in 1918 and 1919 were excellent, and it was possible to fix the most favourable periods for treatment and bring them to the notice of persons interested, by notes in the local press.

There is every reason to expect good results from the method in future.

In addition to mildew, the Station of Bel-Air and its outposts deal with other diseases of the vine and the appearance of its pests ("Cochylis", "Eudemis", etc.), by indicating the most suitable dates for their effective control.

370 – **Keeping Bean Seed until it is Old as a Means of Controlling Bacterial Blight of Beans (*Bacterium Phaseoli*).** — RAPP, C. W., in *Science*, New Series, Vol. L, No. 1303, pp. 568 Lancaster, Pa., Dec. 19, 1919.

In the course of research on the bacterial blight of beans (*Bacterium Phaseoli* E. F. Sm.) at the Oklahoma Agricultural Experiment Station

in the United States, it was noticed that the most effective method hitherto evolved for eliminating the disease is the use of old seeds in sowing.

To test this fact, the infected seed obtained from experimental plots at the above-mentioned Station was collected each year and stored. Beans 4 and 5 years old have never produced plants attacked by bacterial blight, but the percentage of germination has been so low as to prevent their use under actual farming conditions. Seed 2 and 3 years old — with one exception ascribed to accidental infection — have given plants free from bacterial blight.

Results obtained, show that the use of seed 2 and 3 years old furnishes plants free from *Bacterium Phaseoli*, when planted in uninfected land and at a sufficient distance from other areas cultivated under beans, to insure the impossibility of accidental infection. Such seed, moreover, has a sufficiently high percentage of germination to make its use practical under actual farming conditions.

DISEASES OF VARIOUS CROPS

371 - ***Colletotrichum Lindemuthianum*, attacking the "Chevrier" Bean, in Austria.** — See No. 316 of this *Review*.

372 - ***Phoma* sp., a Deuteromycete Parasitic on *Cupressus* spp., in South Africa.** — BOTTOMLEY, A. M., in *The South African Journal of Science*, Vol. XV, No 8, pp 613-617; 4 pl. Capetown, 1919.

A severe attack by a disease, then unknown, on some young plants of *Cupressus torulosa* and *C. arizonica* at Belfast, Transvaal; was first noticed in March, 1915. Examination of the diseased plants revealed the presence of three fungi, *Pestalozzia* sp., *Phoma* sp. with typical pycnidia and small globose spores, and another *Phoma* with pycnidia of an unusual shape and rather large fusiform spores. As a result of inoculation and cultural experiments made during the same year it was possible to ascertain that the third fungus was the cause of the disease.

A still more serious outbreak, identical with the first as regards symptoms and results, but showing the presence of the second *Phoma* only, was noticed on *C. macrocarpa* at Pretoria in March, 1918.

Recently the fungus has been identified with a *Phoma* described by HAHN, HARTLEY and PIERCE as parasitic on *Juniperus* spp.

The disease caused by the fungus is characterised by discoloration followed by withering and the death of the leaves and stems attacked; small black dots, which are the fructifications (pycnidia) of the fungus, are present on the dead leaves and stems.

In the inoculation experiments made, wounded plants were infected in a few days, while unwounded plants were, with difficulty, infected only after some weeks. It was discovered that moisture is essential for the development of the disease.

Spraying with Bordeaux Mixture is recommended as an effective means of controlling the disease.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

RESISTANT PLANTS

373 – **Varying Behaviour of Various Kinds of Tobacco as Regards Insects, in Cambodia.** — See No. 330 of this *Review*.

MEANS OF PREVENTION AND CONTROL

374 – **Comparative action of Chloropicrin on the Injurious Beetles *Calandra oryzae* and *Tribolium navale* (= *T. ferrugineum*)** (1) BERTRAND. — G., BROCQ-ROUSSEU and DASSONVILLE, in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 2nd Half-year, 1919, Vol. CLXIX, No. 26 (Dec. 29, 1919), p. 1428-1430, Paris, 1919.

Tribolium navale F. (= *T. ferrugineum* F.), which lives in the caryopses of damaged cereals, in bran, old flour etc., has been observed by the authors, but only in smaller numbers, in maize, more strongly attacked by *Calandra oryzae* (2). According to a preliminary experiment it appeared to the authors that *T. navale* is unable to attack healthy caryopses, and that it is only able to live on those which are already perforated by *C. oryzae*. It causes less extensive damage than that caused by the other beetle, but nevertheless its destruction is necessary especially in certain determined cases.

It may be supposed that the treatment of caryopses with chloropicrin, in the circumstances previously indicated by the authors, would destroy, at the same time, *C. oryzae* and the other parasites which eventually accompany it. But the authors have shown that, restricting themselves to the limits in strength and time which assure the death of *C. oryzae*, the *Tribolium* beetles resist; and the separation of the two parasites is, so to speak, quantitative.

Does *T. navale* protect itself better than *C. oryzae* in the interior of caryopses? Is it less sensitive to the action of the toxic vapour? In order to prove this the authors measured, in a series of parallel experiments, the comparative action of chloropicrin on *T. navale* and *C. oryzae*, proceding as in their previous experiments.

The results obtained were as shown in the following table, the insects being collected in groups of 10, the capacity of the flask being 8 litres, and the temperature between +14° and +19° C.

These results show clearly that the cause of the separation of the species of insects in the treatment of the infested caryopses is explicable by their unequal resistance to chloropicrin.

The comparative measures have been completed by the following experiments:—

(*a*) In 2 8-litre flasks were placed 6 litres of maize containing *C. oryzae* and *T. navale*; in the first flasks was placed a dose of chloropicrin corresponding to 25 gm. per cubic metre, and into the second a dose

(1) See *R.*, July-Sept., 1919, No. 1049-1050; *R.*, Jan., 1920, No. 148; *R.*; Feb. 1920, No. 274; See also No. 378 of this *Review*. — (2) See *R.*, Jan., 1920, No. 148. (*Ed.*)

Number of grammes of chloropicrin per cubic metr	Fatal time *C. oryzae*	*T. navale*
	h. m.	h. m.
1.	15.0	40.0
2.	8.15	17.30
3.	6.15	10.0
4.	5.10	7.50
5.	4.30	6.15
6.	3.45	5.15
7.	3.35	4.30
8.	3.0	4.15
9.	2.30	4.0
10.	2.15	3.45
15.	1.30	2.50
20.	1.20	2.10
25.	1.5	1.35
30.	0.50	1.20

corresponding to 30 gm. ; after 24 hours all the *C. oryzae* beetles were dead and about 50 % of the *T. navale* beetles remained alive.

(*b*) The conditions were the same as those in the preceding experiment but the time was longer ; after 24 hours only the *C. oryzae* beetles were dead ; after 60 hours all the *T. navale* beetles were also dead.

(*c*) As in *a* and *b* but increasing the quantity of chloropicrin ; with 38 gm. per cubic m. after 48 hours there were still some *T. navale* beetles alive ; with a dose of 40 gm. and after the same time all the insects were dead.

From a practical standpoint it is easy, on a basis of the quantitative results obtained, to determine the necessary conditions for the simultaneous destruction of the two species of beetles. The authors have succeeded, in the case of maize, in treating caryopses enclosed in sacks, exactly as they have described in the case of *C. oryzae* (1), but allowing the chloropicrin to act for at least 24 hours.

INSECTS, ETC. INJURIOUS TO VARIOUS CROPS

375 – ***Tetranychus telarius*, a Mite injurious to the "Chevrier" bean, in Austria.** — See No. 316 of this *Review*.

376 – ***Sphaerolecanium prunastri*, Scale Insect Injurious to Plum Trees, in Italy.** — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola Superiore d'Agricoltura in Portici*, Vol. XIII, pp. 70-126, 38 figs. Portici, 1919.

Morphological and biological description of *Sphaerolecanium prunastri* Fonsc., recorded hitherto from France, Bohemia, Italy, North America and Japan. This scale insect is certainly of pale arctic origin. In Italy it has been found in Calabria (Cosenza), Campania (provinces of Caserta and Avellino) Apulia (Altamura), in the Abruzzi (provinces of Campobasso and Aquila), in the Marches (province of Macerata), in Umbria (Bevagna) and in the south of Sardinia.

The favourite host of this scale insect is the wild plum (*Prunus spinosa*), followed by the cultivated plum and, according to certain writers, also the peach.

(1) See *R.* Jan., 1920, No. 148. (*Ed.*)

The damage caused by the insect is direct, by the abstraction o nutritive sap, and indirect by the abundant sugared substance which i ejects by the anus and which serves as food for "fumagines".

S. prunastri has, in Italy, various natural enemies, of which the au thor describes the morphology and biology as well as the respective hyperparasites.

Among the beetles which prey actively on the scale insects are *Exochomus 4-pustulatus* (L.) and *Hyperaspis campestris* Herbst. The larvae of the latter have been found, to a small extent, attacked by *Homalotylus flaminius* (Dalm.).

Among the hymenopterae which have been recorded as parasites o the scale insect are :— *Coccophagus scutellaris* (Dalm.) Westw., *C. howard* Masi. *Phaenodiscus aeneus* (Dalm.) — in their turn attacked by *Cerapterocerus mirabilis* (Westw.), *Pachyneuron coccorum* (L.), *Perissopterus zebri* (Kurdjumov) and by the mite *Pediculoides ventricosus* (Newp.), *Aphicus punctipes* (Dalm.) and *Microterys lunatus* (Dalm.).

377 – **Insects Injurious to the Avocado (*Persea gratissima*), in the Islands o Trinidad and Tobago, West Indies.** — URICH, F. W. in *Bulletin of the Department o Agriculture, Trinidad and Tobago*, Vol. XVIII, Part. 3, pp. 129-131, 2 pl. Port-of Spain, 1919.

Full grown trees of *Persea gratissima* are generally free from insect pests and only occasionally suffer from scale insects and from caterpillars of the moth *Stericta albifasciata* ; on the other hand the Avocado in the early stages of its growth is very liable to insect attacks. During the dry season scale insects find themselves in very favourable conditions for increase, and at the commencement of the rainy season caterpillars may be found in large numbers.

The following insects have been noticed up to date on the Avocado :— (*a*) Ants :— (1) *Solenopsis geminata*, a serious pest to young plants, not only because it encourages and protects the increase of scale insects generally, but also because it eats the tender bark of young shoots and stems ; they can be controlled by destroying the nests with carbon bisulphide and potassium or sodium cyanide ; boiling water may also be used ; the treatment will be more effective if a little resin wash is added to the boiling water ; if the ants are on the roots and stems, spraying with resin wash and nicotine can be resorted to, but frequent applications may be required as the ants very soon return from neighbouring nests to the plants. Trees can be protected by means of bands painted with special sticky substances ; napthalene flakes dusted round a plant will keep ants away for a few days.

(2) *Cremastogaster brevispinosa*, a species of ant less injurious than the preceding one because it confines itself to protecting the scale insects living on the tree without eating the bark ; it makes its nest under loose dry bark and in rotten wood ; the nests should be removed as completely as possible and the places should be painted over with crude oil or strong resin wash.

(*b*) Scale insects :— (1) *Pulvinaria pyriformis* ; (2) *Aspidiotus destructor* ; (3) *Saissetia nigra* ; (4) *Pseudococcus nipae* ; (5) *P. citri* ; the first of these is the most common of the five ; hardly an Avocado tree is entirely free from it ; most of the scale insects can be controlled by their natural enemies by keeping ants away from the tree ; when numerous, spraying with nicotine sulphate in combination with resin wash or soap can be recommended.

(*c*) Moths :— *Stericta albifasciata* :— sporadic attacks by the caterpillars of this moth, which destroy the young leaves and flowers of the Avocado are noted ; the caterpillars are gregarious and live in nests made by webbing leaves and branches with silky filaments ; usually the caterpillars are controlled by natural enemies of which the most important is a tachinid fly ; they may also be destroyed by removing the nests and burning them, but this has to be done with care and despatch as the caterpillars, when alarmed, let themselves down to the ground by silken threads and disappear in the grass.

(*d*) Minor pests :— (1) *Selenothrips rubrocinctus* ; (2) *Heliothrips haemorrhoidalis* ; (3) *Aleurodicus neglectus* ; for control, resin wash or nicotine sulphate are recommended.

INJURIOUS VERTEBRATES

378 – **Control Experiments Against Field Mice Made in 1919 in France.** — VAYSSIÈRE, P., RINGELMANN, HALLER and, PLUCHET, E., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 34, pp. 885-889 and 873-877. Paris, 1919.

In 1919 M. P. VAYSSIÈRE first of all made at Léchelle, near Soissons (Aisne), experiments on the use of poisoned baits and in particular with arsenious acid, nux vomica, and carbonate of barium. Rolled oats impregnated with arsenious acid (by means of a barrel turning on a horizontal axis) appears to be specially useful as a bait for distribution in crops damaged by field mice.

But the experiments dealt more especially with, the practical use of chloropicrin (1) in the control of these rodents. This toxic product lends itself easily to treatment on a large scale. It has been applied on over 15 hectares in the Aisne, Oise, and Somme. It suffices (as a measure of precaution) that the workmen should wear protective masks (pattern A. R. S.).

Two methods of treatment have been tried, with pure chloropicrin or an emulsion of 10, 15 and 20 % in potash coconut oil soap. The first inside the mouse holes and the other on the surface of the soil by simply scattering the product. The first of these two methods of destruction would certainly be the most efficacious if it was possible to apply it in practice ; but it is generally impracticable, the number of holes per sq. metre easily amounting to 30 or even 40. With the second method,

(1) See *R.*, July-Sept. 1919, Nos. 1049 and 1050 ; *B.*, Jan., 1920, No. 148 ; *R.*, Feb., 1920, No. 274. (*Ed.*)

about 60 litres of the liquid per hectare are used. Possibly in the future a more rapid method may be devised which would consist, for example, in the use of watercarts furnished with a perforated distributer, at a height of about 10 cm. above the ground. The construction of a special apparatus may also be expected.

The results reported by M. VAYSSIÈRE have suggested the following observations to MM. RINGELMANN, HALLER and E. PLUCHET.

M. RINGELMANN is not in favour of spraying chloropicrin on the soil by any means whatever. The spraying of any liquid leads to the evaporation of this liquid and an heavy discharge of the gas which it contains in solution, which, in the present case, would be dangerous for the workmen. Further, the work of spraying is relatively hard. Finally the speed in advancing should be relatively low so as to apply sufficient liquid per unit of surface.

The application of chloropicrin by watering, if this process is recognised as effective, seems to M. RINGELMANN the most practical; it is only a case of moving a watercart over the fields, which is possible by giving the wheels a width of rim sufficient to prevent them from sinking too deep and thus increasing the power needed for drawing them. The reservoir for the liquid can communicate (by a distributor similar to that described in the case of the introduction of the liquid in the soil) with distributors working over a great width; the apparatus could be moved fairly quickly by using a tractor.

For the introduction of the toxic liquid into the soil a scarifier or cultivator is used whose working parts are fitted behind with a small tube, which allows the toxic liquid to run out to the desired depth, in the required quantity for each metre passed over, the liquid coming from a reservoir fixed on the frame of the cultivator. The reservoir would be provided with a rotary distributer or, what is simpler, mounted like a Mariotte vase, ensuring a constant delivery per unit of time. In any case the materials to be used in construction would have to be resistant chloropicrin, a question which concerns chemists.

M. HALLER observes that any apparatus made of metal, particularly of iron, would be damaged by chloropicrin, as all chlorine compounds attack iron; the apparatus would be useless in a short time. It is necessary, therefore, to use wood or vulcanite, but the apparatus would be too expensive. On the other hand, chloropicrin can only be used until present stocks are exhausted, since if it had to be made specially for controlling field mice the cost would be too high.

Finally, M. E. PLUCHET has suggested a very simple process for the control of field mice, successfully tested by him and which he has seen carried out in La Bauce. This process consists of making, by means of a borer, holes 50 cm. deep in the soil, in the runs of the mice; the walls are smooth, and the field mice who tumble into the holes cannot get out of them. If this method does not destroy all the field mice, at least it destroys a great number.

ALFREDO RUGGERI, *gerente responsabile.*

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The Editor's notes are marked (*Ed.*).

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INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART
ORIGINAL ARTICLES

Agricultural Accounting Offices in Sweden

by Professor H. JUHLIN-DANNFELT
Secretary of the Royal Academy of Agriculture of Sweden.

Since the beginning of 1890, great efforts have been made to speed-up the development of small farms in Sweden, and, in this connection, attempts have been made to encourage the small farmers to keep accounts regularly (1) especially by giving premiums to those that do this. The money required has been furnished by the " Riksdag " which, since 1910, has voted an annual appropriation of 15,000 kronen (2). This sum is distributed to societies for rural economics, or to accounting unions for use in this way, especially to subsidise accounting bureaux to help farmers to keep their books.

With the aid of this State subsidy, seven societies for rural economics and two accounting unions have established agricultural accounting offices. Of these, only the accounting office of the province of Malmöhus has attained any wide activity, whilst, in the majority of the other provinces, the offices have not become important.

In 1916, the General Agricultural Society of Sweden, which had just been founded, established an " exploitation bureau ", with the objects of aiding farmers to keep accounts, to draw conclusions from them that would be of assistance in managing the farm, and to give advice on questions of rural economics.

(1) See *R.*, Feb. 1913, p. 173 for the article by M. L. NANNESON on the Measures Adopted in Sweden to encourage Book-Keeping among Farmers. (*Ed.*)

(2) 1 gold *krona* = 1 *s.* 1 $^1/_2$*d.* (*Ed.*)

By leaving the scientific elaboration of the accounting material from the accounting bureaux to the director of the " exploitation bureau " of the agricultural society, continuity in all that sphere of activity has been obtained.

The provincial accounting offices are made use of mainly by the small farmers ; generally speaking, only 25 % of those making use of the offices have been farmers owning more than 75 hectares, as this is the largest area for which the State subsidy towards accounting expenses can be claimed.

The proportion proprietors and tenants among those using the offices is not known, but it would probably be the same as that found among the farmers in the country, about 16 % of whom are tenants. On the other hand, the " exploitation bureau " of the agricultural society is made use of largely by farmers owning larger areas.

The income of these offices consists chiefly of subsidies from the State and from the agricultural society on which the office depends, together with small sums paid by members of the society or payments for accounts accredited by the office.

The State subsidy reaches a maximum equal to the sum allowed by the agricultural society and may not exceed 15 *kronen* per account. In addition, it can only be paid during the first four years in which the farmer has recourse to the bureau for help. The upkeep of the " exploitation bureau " of the agricultural society is assured solely by the contributions of farmers who come to it for assistance.

Most of the offices have no other expenses save the salaries paid to the persons who administer them, and the salaries usually consist of a small fixed sum plus contributions from the clients. In the only accounting office of any importance, that of the province of Malmöhus, where over 150 accounts were brought in during 1918, the office staff consisted of four persons with salaries amounting to a total of 8816 *kronen*, while the other expenses such as rent, office supplies, etc., came to 1890 *kronen*. The director, who worked 7 hours a day, was paid 4,000 *kronen*, and travelling expenses amounted to 1250 *kronen*.

At the " exploitation bureau " of the agricultural society, the staff consisted of 6 persons ; the director worked seven hours a day, was paid 12,000 *kronen*, and received a travelling allowance of 40 *kronen* a day. As a general rule, the director should have studied agricultural science. A premium is not paid to farmers for neatly-kept account books.

Two main types of accounting are in use :—

Type A : *Simple book-keeping*. — This is intended to give a general view of the economic condition of the farm. The gross return, the cost of working, and the net yield of all the farming economy are calculated ; the income and expenses are distributed among the various branches of the farm, the commercial movement between these branches is ascertained and, if required, the cost of labour is appropriately distributed, so that all the figures and information that can serve as a basis for the economic calculations necessary to guide the farmer can easily be obtained. In

this type of account, no special calculations are made of the special profit and loss appertaining to the different branches of the farm.

Special accounts are opened for: —

1) the farm;
2) the exploitation of the forests (eventually);
3) the household;
4) private consumption;
5) provisions (eventually); and
6) other sources of revenue (eventually).

The accounts will be kept by the system of double entry.

TYPE B: *Extended book-keeping.* — This consists of the detailed calculation of the profit and loss (special accounts) appertaining to the different branches of farming economy, such as milk production, rearing young stock, pig breeding and, eventually, the different crops. The calculations are sufficiently detailed to show the production costs of the products sold and the transformation value of the products consumed on the farm. This type of book-keeping requires more detailed preliminary data than the former.

The lists and accounts that usually require to be made up are as follows: —

1) Inventory of the assets and liabilities at the beginning and end, respectively, of the financial year;
2) cash account; this also shows the state of credit;
3) account for the products and livestock;
4) day-book showing the hours worked by the men;
5) inventory of dead-stock;
6) account showing the distribution of labour to the appropriate accounts; and
7) household expenses account.

Among these, the first three numbers are always essential, whilst the need for the others depends on the size of the farm, and the extent to which it is desired that the accounts should be kept. In a simpler form of book-keeping, however, the account for products and livestock can be replaced by a household account.

If, in addition to farming, some industry of greater or lesser extent is carried on, such as a saw-mill, flour mill, distillery, starch factory, etc., accounts should be added dealing with these special branches of the farm.

The numbers of audits of accounts made in 1919 consisted of 68 for farms with over 75 hectares of fields and 173 for farms with less than 75 hectares.

During 1918, special studies, based on abstracts of the accounts, were made on 15 properties only. The greatest difficulty met with was the lack of interest shown by the farmers for accounts carefully and suitably kept. The large farmers prefer to keep their accounts themselves, and according to the method with which they are already familiar. The small farmers as a rule keep no accounts at all.

The reports given, do not, therefore, disclose the individual situation of the farmers, and the different farms are indicated by numbers and all the figures are recalculated with hectares as a basis.

Reports published :

L. NANNESON: Results of farm book-keeping in the province. of Malmöhus from 1902 to 1913.
» » Do. from 1913 to 1914.
» » Results of Swedish farm accounts: I) 1914-1915.
» » » » » » » II) 1915-1916.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

379 – **The Comparative Effectiveness of Certain Culicifuges under Laboratory Conditions.** — BACOT, A. and TALBOT, G., in *Parasitology*, Vol. XI, No. 2, pp. 221-236, 1 fig. Cambridge, February 1919. RURAL HYGIENE

A detailed report of investigations of the comparative efficiency of culicifuges, conducted for the British War Office.

For the purpose of testing culicifuges, numbers of *Stegomyia fasciata* (the yellow fever mosquito) bred in incubators were placed in cages kept in the laboratory. The efficiency of the preparations was tested by coating the forearm with a definite quantity of one or other of them, and exposing in a cage, each test being controlled by inserting after a short interval the other and untreated arm in the same cage, the number of bites being compared in each case. By this procedure it was hoped to obtain a measure of the relative protection which the culicifuges might be expected to afford when used under practical conditions against *Anopheles* mosquitoes.

In the first series of trials, conducted within 15 minutes of application, 8 preparations out of a total of 22 tested gave satisfactory results. Their active ingredients were (1) oil of cassia 1 oz. and brown oil of camphor 2 oz.; (2a) oil of cassia 2 ozs and oil of peppermint, 1 oz; (5) oil of eucalyptus 2 oz. and citronella oil, 2 oz. With liquid carbolic acid 4 drops; (9a) crude naphthalene (coke oven) 3 parts and camphor 1 part, (10) "crude Parasit", (15a) light wood oil, 33 % in a wax preparation; (21) oil of turpentine, 22a) "Lawson's Anti-mosquito Compound". These preparations were then tested to ascertain for what period their protection could be depended upon. Preliminary trials indicated that this period was not likely to extend for more than two hours between treatment of the arm and exposure in the cage. None of the preparations gave complete protection in this series of trials; the most efficient were Nos. 1,21, 2a, 15a, and 9a, over a two hours period.

Observations on the behaviour of the mosquitoes during the tests suggest that the protection afforded does not result from a dislike of the

insects to the culicifuge, but to its obscuring the attractiveness of the human odour.

Regarding the make up of the essential ingredients it was found that fluid preparations were inconvenient and tended to be wasteful in application. Soap preparations, unless very soft, are apt to be difficult of economic use and in either case are more readily dissipated by perspiration than waxy or greasy ones. Culicifuges prepared with grease are more easily applied but are not so lasting as those put up with wax. Soft wax preparations, correctly adjusted to the temperature in which it is proposed to use them, are most suitable for out of doors use. The retarding of volatilisation caused by the admixture of the active ingredients with wax or grease is a distinct advantage, but care must be exercised in respect of the relative proportion of active substance to the base. The golden rule is to use as much of the active constituent and as small a quantity of the inert base as is consistent with convenient application and the prolongiation of the period of efficiency.

380 – **The Superiority of Carbohydrates to Fats, in their Action of Economising Albumin, is Compatible with the Superiority of Fats over Carbohydrates in the Utilisation of Albuminoids** (1). — MAIGNON, F., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXII. No. 34, pp. 1358-1360. Paris, December, 27 1919

The facts known may be summarised as follows :—

1) The administration of carbohydrates to a starved dog reduces the nitrogen excreted in the urine by 55 % (WIMMER), while with fat, the reduction amounts to 2 % only (A. BARTMANN).

2) In man, a fat diet increases the nitrogenous excretion compared with a mixed diet, whilst a carbohydrate diet reduces it (CATHCART).

3) In feeding meat with carbohydrates, the fixation of albumin in the dog is slightly greater than when feeding fats and meat ; it is about 5 % greater (C. VOIT, ATWATER). The same result is obtained by replacing the albumin with a mixture of amino-acids (LÜTHJE).

The action on the fixation of albumin can be explained either by a better utilisation of the proteins with carbohydrates, or by admitting, with LANDERGREEN, FALTA and GIGON, that the organism always has need of sugar and that fat, which cannot supply it, as the author helped to show in the case of mammals, makes it necessary to destroy a supplementary quantity of albumin in order to provide for the formation of glycogen.

The first hypothesis does not explain the economising action ; in addition, it is contrary to experimental evidence which shows that fats are superior in the action they exercise on the way in which the albuminoids are utilised. These facts may be stated as follows :—

(1) See also *R.*, Nov. 1918, Nos. 1195 and 1196. (*Ed.*)

1) In the white rat, egg-albumin, whose ingestion is never followed, as with fibrin and casein, by an excess of fat in the liver, is the only one of these three proteins which is affected by the season and has periods of great toxicity during the spring and autumn.

2) The addition of a small quantity of fat ($^1/_5$) to this same albumin does away with its great poisonous effect.

3) With mixtures of egg-albumin and fat, a constant weight can be maintained for a prolonged time, much more easily and often than with mixtures of egg-albumin and starch.

4) The minimum quantity of albumin that has to be introduced into the ration to obtain this result is much greater with starch than with fat (1 : 3).

On the other hand, the optimum ration of egg-albumin and fat that will keep the weight constant, contains fewer calories than the corresponding ration of egg-albumin and starch.

Therefore, albumin is better utilised with fat than with starch ; it is less poisonous and its food value is higher.

5) Casein, which is made use of by the dog without the help of the reserve fats (constant weight), is much more toxic to that animal (fatty disintegration of the kidneys, arteriosclerosis of the myocardium), than to the white rat, whose weight cannot be kept constant.

The second theory, based on the need for the presence of carbohydrates in the organism, explains both the saving obtained and the action on the fixation of albumin. In the case of albumin-fat rations, two factors tend to make the quantity of albumin required vary inversely ; on the one hand, the necessity for forming glycogen at the expense of part of the albumin ingested, and on the other, the better utilisation of the part left over for protein-formation. There is nothing surprising in the fact that, in the dog, which has a greater power of protein-utilisation than the white rat, as the author's experiments have shown, the former influence predominates, while the latter preponderates with the rat. The author has already pointed out that, in problems of nutrition, the species of animal made use of must be taken into consideration. Thus, the results obtained with the white rat are in no way opposed to those obtained by C. Voit, Atwater and Lüthje with the dog. The theory of the superiority of fats with regard to the utilisation of albuminoids also obtains a striking confirmation from clinical and rearing practice and chemical experiments (L. C. Maillard).

Crüsius and the zootechnicians are, generally speaking, agreed that the most suitable rations for fattening animals are those that are rich both in protein and fat. The clinical effects obtained by administering vegetable oils in the case of cachetic diseases accompanied by nitrogenous denutrition — diabetes, tuberculosis — showed an extremely marked economy as regards the destruction of albumin, which can only be explained by the intervention of fats in the nitrogenous metabolism. The chemical researches of L. C. Maillard also show the superiority of fats over carbohydrates in protein formation.

381 – **The Vitamine Problem** (1). — PUGLIESE A., in the *Reale Istituto Lombardo di Scienze e Lettere, Rendiconti*, Series II, Vol. LII, Pt. 16-18, pp. 723-730 + Bibliography of 8 Works. Milan, 1919.

Of late years, vitamines, the composition and reaction mechanism of which still remain to be cleared up, have been added to the nutritive principles considered to be necessary in alimentation.

According to the modern conception of the vitamines, they are not only matter necessary for the proper functioning of the organism and for repairing the wastage introduced with the food, but are also substances with the function of regulating the exchange, so that the organism has a triple regulating system ; 1) nervous ; 2) humoural ; and 3) another outside the organism and depending on substances that occur in minimum quantities in the food.

Vitamines have been compared to hormones, as they both act in minimum quantities, offer considerable resistance to heat, and act in the chemistry of the body. But, according to the author, vitamines should be clearly distinguished from hormones properly so-called, products of very differentiated secretions of the endocrinal glands, which originate from the metabolism of the body and constitute its " humoural correlation ". Hormones, on the contrary to vitamines, act in the same way on very different animals, and are not destroyed by sterilisation.

It is still more erroneous to consider vitamines as enzymes. The author has found that pigeons, even very young ones, fed for several months solely on hulled, but not polished, rice, heated for a few hours to 100-105°C. (a temperature which certainly destroys the enzymes contained in the seeds of cereals), grow very well ; rice heated in this way, perhaps owing to the aroma caused by roasting, is even much liked by pigeons. " If it is not admitted that vitamines are comparable to hormones and enzymes, their mode of action becomes too obscure, and their actual existence becomes doubtful ",

The harm caused by rearing with sterilised milk can be explained much better than with the vitamine theory, by the incomplete observation of the meticulous care required by sterilisation, and better still by the relative heterogeneity of cows' milk in relation to maternal milk.

The author also thinks that it is not possible to attribute to vitamines, such as most people now understand them, the results obtained, mainly by American workers, by studying growth development, due to the addition of milk, butter, or extracts of plant or animal foods to a known food mixture.

As regards adult animals, few diseases can be classed among those due to lack of vitamines, e. g., beri-beri, scurvy, pellagra, and possibly only the first of these.

(1) See also *R.*, April 1916, No, 415 ; March, 1917, No. 260 ; June, 1917, No. 556 ; January, 1918, No 2 ; February 1918, No. 125 ; August, 1918, No. 834 ; January, 1919, No. 6 ; October-December, 1919, Nos 1068-1072 ; January, 1920, Nos 3, 4, 5 ; February, 1920, No 157. (*Ed*).

When guinea-pigs, which are eminently phytophagous, are fed solely on seeds, their urine, which, as with most herbivora, is alkaline and almost or entirely free from phosphorus, becomes very acid and rich in phosphorus ; it contains more lime and ammonia and occasionally, so the author has found, even acetone and fatty acids. There is a rapid and acute loss of minerals from the body, especially phosphorus and lime.

The various experimental animals, even those belonging to the same species, show a very different resistance to a given dry food ration as regards the period at which the repugnance for food first appears ; those animals that lose appetite at the latest date are those that show the perversion of their food exchange most slowly.

With guinea-pigs fed on dry hay, the quantity of urine decreases, but remains very alkaline and with very little phosphorus ; this, therefore, excludes the possibility that the injurious action of dry seeds on guinea-pigs and rabbits might be due to their lack of water. The essential difference between dry seeds and dry hay lies in the fact that the latter has a much higher content of salts and contains aromatic substances which make it appetising for all herbivorous animals.

Dr. G. Rossi (" Sullo scorbuto sperimentale. La possibilità di una sterilizzazione ad elevate temperature, la quale non alteri il valore alimentare delle sostanze sterilizzate, *Archivio di Fisiologia*, Vol. XVI, pp. 125. 1918) found that grass sterilised in a closed vessel and which consequently retains its aroma, is excellent, on the contrary to grass sterilised in a closed vessel, for feeding guinea-pigs.

For this reason, the author considers it as not proved that the trophic disturbances encountered in feeding with dry seeds depend on the lack of antiscorbutic vitamines, but rather that they are due to changes in the reaction of the organic liquids, resulting in an intensely acute loss of mineral matter from the organism, especially phosphorus and lime. He believes that the problem belongs mainly to the domain of physical chemistry, and he is continuing to work in this direction.

382 - **Researches on the Fat-soluble Accessory Substance.** — Drummond, J. C., in *Biochemical Journal*, Vol. XIII, No. 1, pp. 81-94 ; 95-102. Liverpool, February, 1919.

I. — *Observations upon its Nature and Properties.* — The standardised method adopted by the author in testing substances for the presence of fat-soluble *A* is as follows : young healthy rats weighing about 50 gm,. each were fed upon an artificial ration consisting of purified casein 20 parts + purified starch 50 parts + salt mixture 5 + yeast extract (source of water-soluble *B*) 5 + butter fat (source of fat-soluble *A*) 15 + filtered orange juice (source of the antiscorbutic factor or water-soluble *C*) 5 parts. The rats which give evidence of a normal power of growth were removed from the complete ration when they attained an average body weight of 70 to 80 gm. and were given a similar dietary in which the butter fat was replaced by an equivalent amount of hardened linseed oil which is known to be deficient in fat-soluble *A*. When it was definitely established that growth was inhibited by this deficiency of fat-soluble *A*, the linseed oil was wholly

or partially replaced by the substance to be tested and the behaviour of the animal closely watched for a period of from 4 to 6 weeks. Absence of fat-soluble *A* was indicated by failure to grow, followed by a decline in health accompanied by the characteristic eye condition.

The results obtained in a study of the properties of fat-soluble *A* according to the above method are summarized as follows :—

Fat-soluble *A*, present in certain oils such as butter fat and whale oil, is readily destroyed by exposure for one hour to a temperature of 100° C. ; by exposure for a longer period of time to temperatures ranging from 50° to 100° C., and by exposure for several weeks to a temperature of 37°. The destruction is apparently not a result of oxidation or hydrolysis.

Fat-soluble *A* is not extracted from oils by water or dilute acid, but is soluble in alcohol and may be removed in small quantity from oils by cold extraction with alcohol. Hydrolysis of oils in a non-aqueous medium at room temperature causes disappearance of fat-soluble *A*.

In regard to its composition, fat-soluble *A* has not been identified with any of the recognized components of fats such as glycerol, saturated or unsaturated fatty acids, cholesterol, lecithin, phosphatids, or lipochromes. No evidence has been obtained to suggest that it is not a single substance, but indications point to its being a labile substance of ill-defined constitution.

II. *Observations on its Role in Nutrition and Influence on Fat Metabolism.* — The studies reported in this paper concern the indispensability of fat-soluble *A* in the diet of the adult and the connection between the metabolism of fat-soluble *A* and the fat of the diet.

Feeding experiment conducted according to the method described above indicate that the adult animal organism requires a regular supply of fat-soluble *A* which is much smaller than the requirement of the young growing animal, but is an important factor in the maintenance of health. It appears probable that the resistance to diseases of bacterial origin is seriously impaired by a failure of the animal to obtain a sufficient supply of the fat-soluble factor. There is therefore every reason that great care should be taken to insure that dietaries of adults contain an adequate supply of foodstuffs in which fat-soluble *A* is present.

The symptoms associated with a deficiency of fat-soluble *A* appear in comparable groups of rats after the same period of time whether the diet contains neutral fat or not. This, together with the fact that fatty acids are absorbed and synthesised into fats, and fats are absorbed in the absence of fat-soluble *A*, is thought to suggest indirectly, that pure neutral fats may be dispensable components of the diet.

GRICULTURAL METEOROLOGY

383 - **Comparative Studies on Evaporation carried out under Identical Experimental Conditions, in the U. S. A.** — SHRELL, C. A., in *The Plant World*, Vol. XXII, No. 7, pp. 210-215. Tucson, Arizona, July, 1919.

Some years ago, the United States Department of Agriculture commenced a series of large-scale researches in order to study the progress of evaporation under standardised conditions that were typical and uniform.

A few stations were already in existence in 1916, but more were added so as to form a close network stretching over the whole area of the country particularly in the driest regions in the west. By January, 1918, there were 30 stations on the continent and one at St. Juan (Porto Rico).

TABLE I. — *Monthly evaporation, air flow, and monthly temperature data.*

Date	Evaporation in inches	Air flow average miles per hour	Temperature Fahrenheit
August 1916	8.245	4.25	79.19
September . . . . . »	7.761	4.62	67.17
October . . . . . »	5.128	5.03	56.25
November . . . . . »	2.013	6.92	52.4
March 1917	5.953	7.87	44.9
April . . . . . »	5.681	6.61	52.8
May . . . . . »	5.701	3.73	58.2
June . . . . . »	8.385	3.525	71.65
July . . . . . »	11.061	2.83	80.4
August . . . . . »	6.956	2.09	73.57
September . . . . . »	5.445	2.61	69.35
October . . . . . »	4.114	3.645	50.64
November . . . . . »	3.079	3.72	47.4
April 1918	4.821	4.03	48.45
May . . . . . »	8.453	5.2	68.35
June . . . . . »	9.325	2.65	77.45
July . . . . . »	9.881	2.76	77.6
August . . . . . »	12.020	3.42	83.71

These stations, both by their orientation and by the arrangement and construction of the instruments, are arranged in such a way as to obtain the greatest possible uniformity in the experimental conditions. The pan has a diameter of 48 inches and a depth of 10 inches. The collection of data (under uniform conditions of observation) from regions with great differences of climate, will make it possible to make a comparative study of the climates in the different sectors of the United States, by providing the elements of the scientific ecological examination of the agricultural environment.

The distribution of the movements of the air during the year should be correlated to a certain extent with the growth of the vegetation. This has little effect in spring and autumn, but as spring merges into summer and the foliage increases, the covering of vegetation offers an increasing resistance to the displacement of the surrounding mass of air. At the same time, the convection currents are more energetic at the beginning and end of the season, on account of the rapid and frequent variations of temperature. The correlation coefficient between evaporation and air movement is apparently lower ($r = +0.29 \pm 0.027$) than the correlation coefficient between evaporation and temperature. This second correlation is well illustrated by Table II.

TABLE II. — *Correlations between evaporation and temperature.*

Average daily temperature (Fahrenheit)

Daily evaporation in inches.	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	*Totals*
0.100	1	2	19	35	9	8	6	—	—		**80**
0.200	—	1	8	29	42	40	28	1	—		**149**
0.300	—	—	—	6	28	36	54	16	—		**140**
0.400	—	—	—	1	7	17	39	34	—		**98**
0.500	—	—	—	—	—	2	11	21	2		**36**
0.600	—	—	—	—	—	1	3	11	—		**15**
0.700	—	—	—	—	—	—	—	1	1		**2**
0.800	—	—	—	—	—	—	—	—	3		**3**
0.900	—	—	—	—	—	—	—	1	—		**1**
Totals.	**1**	**3**	**27**	**71**	**86**	**104**	**141**	**85**	**6**		**524**

The coefficient of correlation between temperature and evaporation is 0.687 ± 0.0156. The evaporation is, of course, calculated from the free surface of the pan; the conditions are much more different in the case when the evaporation takes place from the surface of the soil or of plants, a subject about which little is as yet known.

In any case, the large mass of data collected under uniform experimental conditions will greatly aid in facilitating the analysis and comparative study of climatic conditions in relation to ecology in general.

384 – **Cultural Tests of Wheat in Tonkin with Regard to Local Climatic Conditions.** — See No. 416 of this *Review*.

385 – **The Effect of Meteorological Factors on the Growth, Morphology and Yield of the Tepary Bean (*Phaseolus acutifolius* var. *latifolus*).** — HENDRY G. W., in the *Journal of the American Sociiety of Agronomy*, Vol. II, No. 6, pp. 247-252 + 1 Plate. Washington, September, 1919.

The unusual capacity possessed by *Phaseolus acutifolius* A. Gray var. *latifolius* Freeman, of adaptation to a very arid climate and environment

was described by FREEMAN in 1912 at the Arizona Agricultural Station. Since then, this leguminous plant has become one of the most important crops cultivated in the arid districts in the south-west and it is already spreading to the valleys in the interior of California. By 1918, the area covered by the tepary bean in this region amounted to over 22 million acres.

From a series of experiments and cultural tests carried out during the last five years in various Agricultural Stations in California, it has been found that the type of climate in which *P. acutifolius* prospers is well defined in certain of its most characteristic elements.

An accurate study was made of the effect of meteorological conditions on the growth of the bean, and its behaviour in relation to the cool coastal climate prevalent in the maritime regions of central and northern California.

Plants growing in the semi-arid districts in the interior of the country have a spreading and clinging habit, and, under favourable conditions may attain a total length of 40 feet. On the contrary, however, plants growing in the damp coastal regions to the north of Point Conception, develop abnormally :— 1) they become bushy, compact, with a tendency to a dwarfed condition ; the tendrils are lacking and the plant is rarely longer than 18 inches ; 2) the leaflets are smaller and thicker ; 3) the pods are more numerous, short and broad, with few seeds ; 4) the seeds take on a characteristic grey colour ; they absorb moisture directly from the air and become larger to a certain extent ; they often begin to germinate within the pod before the plant stem is full grown ; 5) the period of growth is prolonged indefinitely and the foliage remains green until destroyed by the first autumn frosts.

PRODUCTIVITY OF *P. acutifolius* IN THE ARID REGIONS IN THE INTERIOR OF CALIFORNIA. — Cropping tests were carried out in three localities, Davis, Fresno and Riverside, situated in northern, central and southern California respectively.

The figures showing the yields of *Phaseolus acutifolius* and *P. vulgaris* are given in the following table :—

Localities	Number of years	Avarage yield in lb. per acre	
		Phaseolus acutifolius	*Phaseolus vulgaris*
Davis	3	813	469
Fresno	2	2998	321
Riverside	1	3111	681

Owing to its greater resistance to drought, *P. acutifolius* does better than *P. vulgaris*, and shows up more and more as a crop particularly suited to all the semi-arid belt.

PRODUCTIVITY OF *P. acutifolius* IN THE DAMP, COASTAL REGION OF CALIFORNIA. — Comparative cultural tests were carried out at the Berkeley (central coastal region), Santa Cruz (south-central coastal region), and Smith River (northern coastal region) Stations. The yields were as follows :—

Localities	Yield in lb. per acre	
	Phaseolus acutifolius	*Phaseolus vulgaris*
Berkeley	1244	1512
Santa Cruz	—	562
Smith River	155	683

In these localities, *P. acutifolius* was clearly inferior to *P. vulgaris*. The requirements and climatic limits of the tepary bean are thus fairly clearly determined, as it is plainly xerophilous and incapable of adapting itself to a damp climate.

RELATION OF THE CLIMATE AND DATE OF PLANTING TO THE PRE-FLOWERING PERIOD. — The duration of this period is so much the longer, the lower the temperature is, and the differences observed with varying dates of sowing can be explained by the diversity of the temperature conditions to which the plants are exposed in the early stages of their development. The most important figures relating to this are given below :—

Berkeley (damp, cool)		Davis (warm, arid)	
Date of sowing	Duration of period between sowing and flowering.	Date of sowing	Duration of period between sowing and flowering
May 1	80 days	April 13	91 days
May 17	78 »	May 30	51 »
July 2	77 »	July 5	42 »
Average	**78** days	*Average*	**61** days

The abnormal duration of 91 days in the case of Davis, with sowing on April 13, is due to a series of abnormal depressions of temperature which occurred after sowing.

The following table, which gives the average monthly temperature for the period from April to December, gives a still better illustration of correlation between the temperature and the period between sowing and the beginning of flowering.

Month	Average temperature		Meses	Average temperatura	
	Berkeley	Davis		Berkeley	Davis
April	13.11° C	14.22° C	September . . .	18.94° C	22.00° C
May	12.94°	15.61°	October	17.22°	19.33°
June	16.67°	22.83°	November . . .	14.22°	12.06°
July	17.22°	25.94°	December . . .	12.67°	8.89°
August	15.61°	23.89°			

RELATION OF THE CLIMATE AND THE DATE OF PLANTING TO THE FLOWERING PERIOD. — This case is very similar to that of the duration of the period between sowing and flowering. The details are given below :—

Berkeley		Davis	
Date of sowing	Duration of flowering	Date of sowing	Duration of flowering
May 1	57 days	April 13	44 days
May 17	35 »	May 20	35 »
July 2	74 »	July 5	35 »
Average	**55** days	*Average*	**38** days

RELATION OF CLIMATE AND DATE OF PLANTING TO THE LIFE PERIOD (from sowing until the plants are completely mature). — This case is similar to the previous one.

Berkeley		Davis	
Date of sowing	Duration of vegetative period	Date of sowing	Duration of vegetative period
May 1	157 days	April 13	148 days
May 17	135 »	May 30	96 »
July 2	166* » +	July 5	92 »
Average	**153** days +	*Average*	**112** days

* Killed by frost prior to maturity.

The plants sown on July 2 at Berkeley were destroyed by the frosts in December before they were mature.

CONCLUSIONS. — 1) *Phaseolus acutifolius* has been cultivated in the cool regions of central and northern California (coastal sectors), where it grew normally.

2) It is more productive than *Phaseolus vulgaris* in the semi-arid districts in the interior of California.

3) It is, however, less prolific than *P. vulgaris* in the damp and cool regions along the coast-line.

4) The duration of the life period, of the period between sowing and the beginning of flowering, and of the flowering period is in a direct ratio with the climatic conditions; it is longer as the temperature is lower.

386 – **The Effect of Low Temperatures on The Floral Buds of the Peach Tree as Regards their Water Content.** — See No. 398 of this *Review*.

387 – **The Capillary Rise of Water in Soils.** — KENN, B. F., in the *Journal of Agricultural Science*, Vol. IX, Pt. 4, pp. 397-399. London, 1919.

The height to which water can be lifted in the soil by capillarity is the subject of varying opinions, the height being variously estimated at from 60 to 90 cm., up to 2 to 3 kilometres, although it is rarely more than 60 metres. MITSCHERLICH, working from the heat of wetting, arrived at the enormous figures of 2 to 3 kilometres, although he obtained esperimentally a rise of only 80 cm. in 3 months.

The author suggests a direct calculation of what may be considered as the probable maximum capilliary lift. Starting from the formula $h = \frac{4\sqrt{3T}}{\delta g K}$, where T is the surface tension, δ the density of water, g the force of gravity, h the height to which water would reach in a tube whose cross section is an equilateral triangle of side K, which constitutes a model of the forces in an "ideal" soil with uniform spherical particles, by successive approximate simplifications, we obtain the formula $h = \frac{0{,}75}{r}$, where r is the radius of the soil particles.

If this formula is applied to the dimensions of the soil particles obtained by the ordinary mechanical analysis, we obtain the following values :—

Soil fractions	Diameter	Capillary rise
Fine gravel	1–3 mm	5–15 cm
Coarse sand	0.2–1	15–75
Fine sand	0.04–0.2	75–375
Silt	0.002–0.04	375–7500
Clay	0.002	7500

These figures show that the possible capillary rise of water in the soil increases rapidly with decreased dimensions of the soil particles. In practice, these figures would obviously require considerable reduction, because soils are naturally composed of a mixture of particles of all shapes and sizes, in which the capillary spaces are irregular in length, width and direction, so that the possibility of capillary rise is considerably reduced.

Again, the trapping of air in the interstices add to it as well as the colloidal portion (in heavy soils) which, by expanding, closes up the pores. Thus the figures in the appended table represent the maximum limits for actual soils with the same porosity, and they are probably much higher than those actually found in practice. In addition, laboratory experiments show minimum values for the capillary rise of water, because it is not possible to reproduce the various meteorological and hydrological factors which, in the open soil, tend to assist capillarity by making the soil and sub-soil more compact.

388 – **Quantitative Relations between Soil and Soil Solution shown by Freezing-Point Determinations.** — KEEN R. F., in *The Journal of Agricultural Science*, Vol. IX, pp. 400-415, + 4 Figs. London, 1919.

After recapitulating his own work on soil evaporation (1), which showed the existence of close relations between the soil and its moisture the author discusses the work of BOUYOUCOS and his collaborators first by the purely qualitative dilatometric method, then by determinations of the freezing-point, a drop in which, enables quantitative relations to be established, especially as regards the " unfree " moisture in the soil, in contrast with the " free " moisture.

By analysing the experimental data obtained by BOUYOUCOS and his collaborators on the lowering of the freezing point of the soil solution with a varying moisture content and determined *in situ*, the author shows that, in quartz sands and in soils of an extremely sandy type, the soil solution obeys approximately the same laws as dilute solutions, as the lowering of the freezing point varies with the concentration or inversely as the moisture content. In other words, if Dn is the freezing-point depression Mn the moisture content, and K a constant, then $Mn\,Dn = K$. But ordinary soils do not obey this law, as the freezing point increases rapidly with increasing moisture, which BOUYOUCOS explains by the fact that part of the water is neither free nor fixed, so that it has no influence on the lowering of the freezing point. The author, accepting these hypotheses, discusses the quantitative consequences and deduces that :— 1) The water which is not freed does not represent a constant amount, but varies with the moisture content ; 2) there are, therefore, definite relations between free, fixed, and total moisture, and if Mn be the total moisture, Yn the free moisture, Zn the fixed moisture, c and x two constants of any soil, these relations can be expressed by the two equations $Yn = cMn$ and $Zn = \frac{1}{c^{\frac{1}{x}}} Yn^{\frac{1}{x}} - Yn$; 3) the ratio of moisture or of free water to total water continually decreases and the ratio of the water that is not free increases with the decrease of total water, and that within experimental limits.

(1) See *R.* 1915, No. 248.
(2) See *R.* 1919, Nos. 151 and 567. (*Ed.*)

Although the actual content of free water decreases with the decrease in the total water, it is impossible to find in what degree the actual content of fixed water varies with the decrease in the total moisture. This uncertainty is explained by the presence of an unknown, but invariable factor in the constant c of the equation given above, and which depends on the limits of the experiments of BOUYOUCOS. In any case, the author's general conclusions are of value in relation to his researches on the evaporation of soil water, *i. e.*, that the soil colloids should be considered first in this phenomenon, that the soil water is always submitted to the same law under experimental conditions, and that the various constants and critical points only represent approximate equilibrium values, without indicating sudden changes in the physical conditions of the soil water.

389 – **The Sterilisation of Soil by Steam.** — POLAK, M. W. (Institut voor Phytopathologie van de Landbouwhoogeschool Wageningen), in the *Mededeelingen van de Landbouwhoogeschool*, Vol. XVII, Nos. 1, 2 and 3, pp. 91-108 + 2 Figs. + 1 Plate. Wageningen, 1919.

The author has continued the work of RUSSELL and PETHYBRIDGE (1) and several American authors on the sterilisation of soil by steam. The experiment was carried out in a greenhouse at the Phytopathological Institute at Wageningen by passing steam through tubes, with a breadth of 70 cm. and a length of 8.5 metres, laid along the axis of a trench dug out of the soil.

The consumption of steam per square metre of soil to be heated was calculated from the formula $Q = 10\ dsct$, where Q is the number of large calories required, d the depth in centimetres of the soil to be sterilised, t the temperature to which the heating is carried out, s the specific gravity of the soil, and c its specific heat. In order to find the number of kg. of steam required, we get $S_t = \frac{Q}{550} = 10\ \frac{d\,s\,c\,t}{500}$; and, with a temperature between 95-100°C., say $t = 96°$ C., we get $S_t = 1.75\ dsc$; the amount of steam required S_p equals $1.75\ dsc = V$, where V represents the loss of steam in kg., which, in the experiment, amounted to 17.5 kg., so that $S_p = 1.75\ dsc + 17.5$. If K be the quantity of coal required to produce this steam, and assuming that 1 kg. of coal produces 7 kg. of steam, then $K = \frac{d\,s\,c}{4} + 2.5$.

In the experiments, d = about 40 cm., $s = 1.2$, and $c = 0.35$, so that $K = 6.7$ kg., and the steam required to sterilise one square metre of soil would be about 47 kg.

The practical question is to find whether it is better to sterilise the soil or bring fresh soil in, to avoid the appearance of soil fatigue, and it depends, apart from the theoretical question, on the installation already available and the relative costs of the two operations.

(1) See *B.* 1913, no. 14. (*Ed.*)

IRRIGATION AND DRAINAGE

390 – **The Effect of Temperature on the Loss from Canals due to Infiltration.** — CRANDALL, I., in the *Engineering News Record*, Vol. LXXXII, No. 7, pp. 323-324 + 2 Diagrams. New York, February 13, 1919.

The author examined the losses through infiltration from canals forming part of an irrigation scheme in southern Idaho, and extended his researches to an irrigated area of about 2559 acres. He found that the loss due to infiltration increases with the temperature of the water. Usually, the variation in temperature during a period of irrigation, (from about 10-21° C.) may lead to a variation of 30 % in the loss due to infiltration, as shown by the appended table :—

Ratio between the loss of water at various temperatures and the loss at 45° F. (taken as equal to 100).

	Losses at		
	50° F	60° F	70° F
Losses calculated by the formula { HAZEN . .	109	128	146
of . . . . . { SCHICHTER	107	125	143
Losses found in the North Side Canal System, except Jerome reservoir; averages of 1916-1917	108	125	141
Losses found in Jerome reservoir (maximum depth, 16 ft. 6 in.)	123	173	218
Losses from Lake Wilson:			
Depth 10 ft. . . .	114	132	165
» 14 ft. 6 in. .	118	148	182
» 19 ft. 6 in. .	122	158	192
» 24 ft.	126	166	200

PERMANENT IMPROVEMENT DRAINAGE AND IRRIGATION

391 – **Experiments on the Improvement of Peaty Soils by means of Sand, in Denmark.** — HANSEN, J., in the *Tidskrift for Planteavl*, Vol. XXVI, Pt. 4, pp. 553-622. Copenhagen, 1919.

Experiments carried out from 1899 to 1916 at the Agricultural Station at Askov, in conformity with the resolution passed at the Agricultural Congress of Copenhagen in 1888, in order to study the effect of covering a typical super-aquatic peat soil some 10 to 16 feet deep with a layer of mineral soil. The improvement was begun in 1899 and, in 1902, three series of plots were marked out in 8 fields each 700 sq. metres in area. One plot was given a dressing of sand 5.2 cm. thick, the second a dressing of sand 10.4 cm. thick, and the third acted as a control. Later on, the sand was incorporated into the peat by ploughing. The crop rotation, after 1906, was :— 1) rye ; 2) leguminosae (peas and beans) ; 3) hold crops (potatoes, mangolds and turnips) ; 4) oats with clover and fodder grasses ; 5-8) clover and fodder grasses. The appended table shows the yields obtained, in quintals per hectare ;—

The effects of improving the soil with sand varied during the experimental period. At first, the yield of rye, potatoes, mangolds, turnips,

Crop.		Without sand	With 5.2 cm. of sand	With 10.4 cm. of sand
Rye.	grain	14	14.3	14.8
	straw	40.1	40.1	38.1
Leguminosae.	seed	8.9	15.3	18.6
	straw	21.5	24.7	24.8
Potatoes (tubers)		287 (dry matter 68.3)	273 (dry matter 65.2)	270 (dry matter 65.1
Mangolds		362 (» » 40.9)	350 (» » 41)	343 (» » 40.7
Turnips		273 (» » 40.4)	263 (» » 40.8)	244 (» » 58.3
Fodder oats	grain	14.4	16.4	16.3
	straw	31.7	29.7	29.4
	hay	14.7	18.0	19.4
Clover with fodder grasses.	1st year	60 5	80.5	90.6
	2nd »	45.1	59.9	65.0
	3rd »	44.6	54.3	55.5
	4th »	32.3	38.4	38.8

and, up to a certain point, oats, diminished considerably. But afterward: except in the case of potatoes, the crops were heavier on the soil improve with sand than on the untreated peat land. The averages of all the ex periments show that, as a matter of fact, rye is not influenced by th sand, while potatoes yield the maximum crop in the untreated soil an the minimum crop in the soil that receives most sand. Mangolds an turnips give a slightly decreased crop in the sanded land, but the yiel in dry matter is approximately the same as that on the improved soi Oats yield more grain and less straw on the sanded than on the untreate land, the quantity of sand used having little or no influence. On th contrary, the leguminous plants and fodder grasses usually gave a constan increase of yield with an increase in the amount of sand applied. If th results of the rotation employed are calculated in "forage units" (1 f rage unit = 1 kg. of grain, 1 kg. of dry matter from root crops, 2.5 k of hay, or 5 kg. of straw), the annual yield per hectare would be:—

2540 forage units on the land without sand
2882 » » » » » with 5.2 cm. of sand
3011 » » » » » with 10.4 cm. of sand

Manuring experiments carried out with the following amounts (quintals per hectare and per year) : — 1) 45.3 farmyard manure + 4.5 kainit + 0.91 basic slag ; 2) 5.89 kainit + 1.81 basic slag + 1.36 nitra of soda ; 3) 8.84 kainit + 2.72 basic slag + 1.36 nitrate of soda; woul give with the rotation quoted above, the following respective numbers forage units per hectare; —1) 2607 ; 2) 2820; 3) 3006.

392 – **The Antwerp Market for Fertilisers and Other Products Useful to Agricultu from 1914-1919.** — *Les Mercuriales Agricoles*, Vol IV, 2nd Series, No. 1, pp. 1. Antwerp, January 2, 1920.

The appended table gives the prices in July, 1914, and the maxim and minima reached in 1919, at Antwerp for the chief products usefl to agriculture.

Names of the products	Price in July, 1914	Price in 1919	
		Minima	Maxima
	francs	francs	francs
Chili nitre . . . . . per 100 kg.	23.00	58.50	93.00
Sulphate of ammonia . . . . . » » »	28.00	80.00	145.00
Cyanamide 15 % . . . . . » » »	22.65	52.00	65.00
Superphosphate . . . . . per unit	0.335	1.47	1.60
Phosphate slag . . . . . » »	0.25	0.80	1.60
		(paper bag)	(paper bag)
Kainit . . . . . per 100 kg.	2.65	7.00	7.00
Potassium Chloride . . . . . » » »	18.00	37.50	37.00
Ammonia (crude) . . . . . per unit	1.00	4.50	
Dried ground blood . . . . . » »	2.10	10.00	
Wool refuse . . . . . » »	0.90	4.00	
Roasted horn . . . . . » »	2.05	6.00	
Leather powder . . . . . » »	1.45	6.50	
Fish meal . . . . . » »	2.20	10.00	
Green bone meal . . . . . per 100 kg.	13.00	42.50	
Phosphated gypsum . . . . . » » «	1.60	3.50	
Copper sulphate . . . . . » » »	56.00	150.00	
Iron sulphate . . . . . » » »	5.25	22.00	24.00
Linseed cake (P. W.) . . . . . » » »	20.25	70.00	102.00
Linseed cake (native) . . . . . » » »	21.00	70.00	90.00
Coconut cake . . . . . » » »	22.50	65.00	75.00
Groundnut cake . . . . . » » »	20.75	60.00	80.00
Rape cake . . . . . » » »	12.75	40.00	50.00
Maize cake . . . . . » » »	15.75	60.00	80.00

Price at end of Dec. 1919

Without exception, the prices of all these products have reached a level that would have been thought impossible. Though this enormous increase is due to various causes, these have arisen, directly or indirectly, out of the war. As long they continue in this way, the situation will remain unchanged and only one of the many remedies suggested is of real utility, and that is, increased production.

393 – **Productions and Distribution of Tunisian and Algerian Phosphates in 1920.** — I. Les exploitations phosphatières françaises in *L'Engrais*, Year XXXV, No. 1, p. 29. Lille, January 9, 1920. — II. Phosphates, *Ibid.*, No. 2, p. 57. January 23, 1920.

An agreement has apparently been made between the chief phosphate companies and the French Government fixing the minimum quantities to be produced by each company in 1920. The distribution is as follows:— Gafsa phosphates, 1 050 000 metric tons; Tunisian phosphates, 400 000 m. tons; Constantine phosphates, 350 000 m. tons; Dry phosphates, 100 000 m. tons; M'Zaïta phosphates, 40 000 m. tons; other phosphates, 100 000 m. tons.

It is estimated that, in 1920, Algeria and Tunisia could produce some 1 400 000 metric tons of phosphate, which will be distributed as far as possible in the following way:—

France	700 000 tons	Belgium	4 000 tons
England	247 000 »	Switzerland	5 000 »
Italy	355 000 »	Spain	74 000 »
Portugal	15 000 »		

The total amount of phosphates that it is hoped will be imported during 1920 is 2 600 000 tons, including the quantities listed above, will be distributed as follows:—

France	1 000 000 tons	Holland	100 000 tons
Italy	600 000 »	Portugal	50 000 »
England	400 000 »	Scandinavia	40 000 »
Spain	200 000 »	Switzerland	10 000 »
Belgium	100 000 »		

394 – **The Influence of Green Manures on the Physico-Mechanical Conditions and Aeration of Rice-Fields.** — See No. 417 of this *Review*.

395 – **The Nitrate of Soda Situation in Europe, the United States, and Egypt.** — *Le Mercuriales Agricoles*, Vol. IV, 2nd. Series, Nos. 3, 4, pp. 10, 13-14. Antwerp, January 16 and 23, 1920.

The consumption of nitrate of soda in the different countries in 1919 and the stocks in hand on December 31, 1919 were:—

COUNTRIES	Consumption in 1919	Stocks in hand on December 31, 1919
	metric tons	metric tons
England	48.000	31.000
Egypt	51.000	—
France	172.000	41.500
Belgium	63.000	24.300
Italy	20.000	—
Spain and Portugal	58.000	9.000
Holland	153.000	6.000
Scandinavia	88.000	5.000
Germany	—	5.000
Totals	**653.000** tons	**122.000** tons

It is stated, on good authority, that, in 1920, Spain, Japan, Scandinavia and Holland will receive quantities of nitrate that are considerably higher those taken before the war, and that there is no uncertainty as to the consumption of the nitrate. The United States, France, Belgium, Egypt and Italy will also receive large quantities of nitrate, but it is predicted that the demand will exceed the supply.

396 – **The Influence of Sulphates on the Vegetative Growth and Composition of Plants** MILLER, H. G., in the *Journal of Agricultural Research*, Vol. VIII, No. 3, pp. 87-102 + 4 Plates + Bibliography of 26 Publications. Washington, 1919.

The author summarises previous work on the oxidation of sulphur in the soil and the influence of the resulting products on: *a*) vegetative growth; *b*) the development of the bacteria and their activity; *c*) the liberation of other food material for the plants. On account of the good effect of fertilisers containing sulphur found in Oregon, the author undertook some greenhouse experiments in order to study the effect of sulphur on the early growth and the composition of plants, and to ascertain whether sulphur acts directly on plants by furnishing them with food or in some other way.

The pot experiments were carried out with clover, rape and oats in two loams and a clay soil; one of the loams was very rich in sulphur. At the beginning of the experiment, sulphur and lime were applied to the pots, which were watered each day with solutions of various strengths of calcium sulphate and sodium sulphate. A similar series of experiments was conducted in sand to which ferrous extracts had been added. Finally, all the pots were watered every day with a solution of sodium nitrate, so as to prevent nitrogen from being a limiting factor. The experiments lasted 2 ½ months, when the dry weight of the green parts was determined as well as, in most cases, the total sulphur and nitrogen.

It was found that, in the series of pots with earth and those with sand, the sulphur led to increased growth, thus showing that the sulphates and free sulphur had a direct fertilising action: again, the sulphates produce increased growth of the roots and the formation of nodules in the clover grown in soil, thus increasing the nitrogen content of that plant.

397 – **Sulphur as a Fertiliser for Lucerne in South Oregon. U. S. A.** — Reimer, F. C.' and Tartar, H. V., in the *Oregon Agricultural College Experiment Station, Bulletin* No. 163, p. 40 + 9 Figs. Bibliography of 11 works. Corwallis, Oregon, 1919.

Recent American researches have shown that leguminous plants, particularly clover and lucerne, require, in order to give their maximum production, a larger quantity of sulphur than is indicated by analytical data. General manuring experiments carried out in South Oregon in 1912 and 1913, showed that superphosphate and gypsum had a beneficial effect on lucerne, which showed a deeper colour, whereas natural phosphate had no effect. In addition, it has been found that lucerne, clover, *Pisum arvense* and the vetch develop better and show a deeper colour when growing under trees treated with lime-sulphur wash than elsewhere.

Experiments were started in 1914, in a medium soil, in order to compare superphosphate, flowers of sulphur, crude phosphate, and sulphate of iron at the rate of 560 kg. per hectare. Compared with the controls, the sulphur, superphosphate and sulphate of iron gave increases in yield of over 100 %, while the natural phosphate had no action.

In further experiments carried out from 1915-1918 on different types of soil (clay, clay loam, sandy loam, gravel), lucerne and clover showed increases ranging from 50-1000 %, owing to the use of various fertilisers containing sulphur (flowers of sulphur, superphosphate, gypsum, sulphates of iron, ammonium, potassium, magnesium and sodium), in all the soils from coarse granitic to the most compact clay soils. Yet the application to the same soils of nitrate of soda, monocalcium phosphate, potassium chloride and lime, had little or no effect on lucerne. It thus would appear that the beneficial action of the fertilisers containing sulphur, mentioned above, is due neither to the liberation of phosphorus, potassium or lime in the soil, nor to nitrification, particularly as the experimental soils were rich in potassium, calcium, magnesium and iron, while they had a low sulphur content, although they were not acid, and contained appreciable amount of no alkaline substances.

When flowers of sulphur are applied to the soil, they must be changed to sulphates before the lucerne can make use of them. This requires a certain time, so that better results are obtained when the sulphur is applied in autumn rather than in spring. During the first year, the gypsum and other sulphur materials gave better results than flowers of sulphur, though they were all given in equal amounts ; but, in the second year, there was little difference between the crops obtained.

The different sulphur fertilisers have a very stimulating effect on the root system of lucerne, which is more developed and possesses more nodules. This is a great advantage as the plant can assimilate more food elements, moisture and atmospheric nitrogen. The analysis of plants treated in the way showed that they contained more sulphur, protein and nitrogen than untreated plants. Lucerne hay from South Oregon contains more sulphur that of the west-central States, and the sulphur content of manured lucerne hay varied from 1.5 to 4.54 lb. per ton, while, in the unmanured plots, it was from 2.36 to 2.54 lb. ; 71-97 % of the sulphur in the lucerne of the treated plots is present in an organic form, and the rest as sulphate ; with the untreated plots all the sulphur in the hay is present in an organic form.

For the district in question, the manuring advised per hectare consists of 200 lb., of gypsum, or 254 lb., of superphosphate, or 45-50 lb., of sulphur with 200 lb., of natural phosphate ; the last combination is the cheapest. It should be remembered that sulphur cannot be applied to soils poor in lime, as it causes acidity in the soil ; in this case, the sulphur should be given only with large dressings of lime or natural phosphate.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

398 – **Correlation Between the Resistance of the Plant to Low Temperatures and the Density of the Cell Sap.** — Earl, S. J., in the *American Journal of Botany*, Vol. VI, No. 9, pp. 373-379 + 2 Fig. Lancaster, Pa., November, 1919.

For the fruit grower the effect of external agents in relation to the resistance of the peach tree to low temperatures constitutes a very important problem which cannot be properly solved until empiric observation is reduced to a minimum and replaced by some sure and accurate physical or chemical measurement. Once such a measuring unit is found, a careful determination should be made of the action of external agents with regard to the degree of resistance of different varieties growing under similar environmental conditions.

Ohlweiler, Chandler and other workers have shown the existence of a positive correlation between the resistance of the plant to low temperatures and the density of the cell sap, a correlation due to the lowering of the freezing point. It is obvious that, in carrying out such a determination, very important factors have to be neglected, as, for example, the shape and size of the cells and the presence of colloids. The shape and size of the capillary network depends on the size and shape of the cells, and the capacity of retaining a varying amount of water depends on the quantity of colloids present. Such phenomena undoubtedly influence the resistance of the tissues.

Salmon and Fleming state that there is no relation between the cryoscopic value (depression of the freezing point) of the sap extracted from

winter rye, from wheat, emmer, barley, and oats, and the resistance to low temperatures. These contradictory statements are due to the omission of important factors such as capillarity, etc.

Beach and Allen have reported a relation between the resistance to cold and the water content of the tissues, as the parts of the plant richest in water are also the most tender and least resistant.

The author carried out a series of experiments during winter, 1918-1919, in order to find whether the moisture content of the fruit buds of two varieties of peach one sensitive and the other resistant to cold, is so different as to furnish an explanation of the different power of resistance to low temperatures. The two varieties Elberta (slightly resistant) and Greensboro (very resistant) were used, and samples, first taken on November 8, 1918, were procured every month.

Each sample consisted of 10 fruit buds, and after their weight had been found, they were placed in an electric autoclave and dried at approximately 82°C. until a constant weight had been reached. After 12-18 hours, the dry weight was determined. The following table includes data showing *a*) the seasonal variation in the green weight and dry weight; *b*) the relation between the water content and the green weight; *c*) the relation between the water content and the dry weight. The dry and green weights each represent an average of 10 determinations.

Dates	Average Green weight in gm.		Average Dry weight in gm.		Ratio between water content and green weight		Ratio between water content and dry weight	
	Elberta	Greensboro	Elberta	Greensboro	Elberta	Greensboro	Elberta	Greensboro
November. 8	0.124	0.121	0.073	0.073	0.41	0.40	0.69	0.65
December. 6	0.144	0.129	0.079	0.073	0.46	0.43	0.84	0.76
January 7	0.144	0.123	0.082	0.075	0.43	0.38	0.76	0.62
February 7	0.164	0.128	0.082	0.075	0.49	0.42	0.99	0 71
March 7	0.327	0.220	0.115	0.092	0.65	0.58	1.85	1.37
March 28	1.050	0.750	0.205	0.160	0.80	0.76	4.12	3.17

The seasonal variations of the dry weight are very small compared with those of the green weight, the increase of which is due to the water. It is interesting to note that the water content in relation to both dry and green weight is always greater in the case of Elberta than in that of Greensboro, a variety which is more resistant to low temperatures in almost every case.

399 – **Researches on the Flowering and Fertilisation of the Wheat Flowers, in the U. S. A.** — Leighty, C. E. and Hutcheson, T. B., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 4, pp. 143-162 + 2 Figs. Washington, April 30, 1919.

Observations made at the Minnesota Agricultural Experiment Station at Saint Paul and on the Arlington (Virginia) Experimental farm, during the summer of 1914, on the flowering time of different varieties of wheat,

and on the fertilisation of emasculated wheat flowers left without protection from heterogamous pollinisation. The varieties examined at flowering time were: 1) Velvet Chaff, Haynes Bluestem, Glyndon Fife, Kubanka, Arnautka, Kharkov, Turkey (at St. Paul); 2) Dietz, Fultz, Mealy, Giant Squarehead, Turkey, Bluestem, and Fife (at Arlington). Each ear was marked, the flowering of each flower was noted, and the data thus obtained shown on a diagram. The observations were usually made at 7a. m., at noon, and from 5-6 p. m. A flower was considered to be in bloom when the glumes had opened to an appreciable extent.

It was found that the flowering of a wheat flower was a very rapid process. After the moment when the glumes begin to open, they may be fully open in less than a minute; the anthers may be extruded and emptied of pollen in 2 or 3 minutes; the glumes may be half-closed again in 5 minutes, loosely closed in 10 and tightly closed in 20 minutes. The entire process, from the first moment when the glumes begin to open to that when they are again tightly closed, seldom requires more than 20 minutes.

More frequent observations were made at Arlington on 25 wheat ears, betwen 4 p. m. on May 26 and 8 p. m. on May 30, and on ten other ears between 2 p.m. on June 1 and 3 p. m. on June 5. Although flowering takes place at any hour of the day, it is most intense at fairly well-defined periods.

The flowering dates of 2977 flowers on 69 ears were recorded: 1492 flowered between 5 or 6 p. m. and 7 or 8 a. m., and 1485 flowered in the daytime. Of the latter, 764 flowered before noon. At St. Paul 70 more flowers flowered at night than in the day; at Arlington 63 flowered more in the day than at night. The hour of flowering apparently depends, up to a certain point, on the variety, although this is not considered by the authors to be the most important factor. In daytime, there are two periods of intense flowering, one between 7-9 a. m., and the other between 2 or 3-4 p. m. In the morning, at about 11 a. m., there may be a secondary flowering period. There is probably at least one period of intensive flowering during the night or early morning hours. The time between the beginning and end of the flowering of an ear varies between 2 and 7, with an average of 3 days. Therefore it is not true that wheat always flowers in the early morning hours and that, in consequence, the opening anthers should be collected at that moment.

The flowers on a number of ears belonging to different varieties were emasculated before their pollen was ripe and no protecting envelope was given, whereas at St. Paul the flowers belonging to ears all of the same variety. were treated in the same way, but covered with soft tissue paper and at Arlington they were placed in paraffined (glassine) paper bags. The varieties used for this experiment in Minnesota were Kharkov, Red Fife, Haynes Bluestem, Velvet Chaff, Glyndon Fife, Kubanka, Arnautka, and, at Arlington, Fultz, Lancaster, C. I. Nos. 3614, 1733 and 1933, Tennessee Fultz, China, Early Genesse Giant, Acme, (Sel. II), Kanred. At St. Paul, the following results were obtained: out of 70 ears emasculated and left uncovered, 1240 flowers gave kernels from 507; out of the emasculated and covered ears, 388

flowers hardly formed 2 kernels; out of the emasculated, pollinated and bagged, 41.7 % of the flowers formed seeds. At Arlington, out of 1324 flowers belonging to 83 ears (emasculated and left uncovered), 1103 formed kernels; out of 642 flowers of 40 emasculated and covered in, only 6 kernels were formed, 3 of which were on ears contained in bags that had been torn.

When wheat flowers are emasculated and not pollinated, the glumes apparently open a little after the usual flowering date and remain open several days; the style grows to an abnormal length, thus facilitating the entry of the pollen. On the contrary, the glumes remain closed when pollination has taken place. Successful fertilisation of *all* the flowers polljnated by hand is quite exceptional. The unfertilised flowers, which often amount to 50 % or more of the pollinated flowers, remain with open glumes, so that some, at any rate, may possibly be fertilised by pollen from other plants.

These results show that, when studying the heredity of wheat hybrids and in operations of crossing when it is desired to obtain hybrids of known parentage, the emasculated flowers must be protected from chance pollination. The opinion to the contrary held by various workers seems, therefore, unjustifiable.

400 – **On the Chlorophyll Production of Plants Exposed to Discountinuous Light.** — Coupin H., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 7, pp. 403-405. Paris, February 16, 1920.

Plants grown in complete darkness are usually pale yellow (etiolated) whilst the same plants grown in daylight are green, owing to chlorophyll formation in some of the cell plastids. The explanation of the appearance of the chlorophyll, in spite of a considerable amount of research, is as yet not completely known. The author, therefore, endeavoured to ascertain, as a contributing factor, the length of time the plants must be exposed, each day, to daylight for the chlorophyll to begin to show. The method employed naturally consisted in growing the young plants in the dark, then exposing them for a varying period during a number of days that varied according to species experimented with diffused, north daylight, until the yellow parts began to assume a slight green tinge, thus showing that chlorophyll was beginning to be formed. The author's results are given in a table; they are, for various reasons (variation of the intensity of the light, difficulty in matching the shade, etc.), approximate only. The conclusions drawn are given below:

1) The time the plants must be exposed each day to the light so that the chlorophyll begins to appear, varies greatly with different species since the appearance of the green tinge under discontinuous lighting may take from 2 (garden cress) to 20 days (peas); from 20 minutes (sun) to 120 minutes (maize) per day; from 25 minutes (pumpkin) to a total of 2400 minutes (peas).

2) The parts that contain abundant reserve materials (cotyledons of pumpkin, white lupin, lucerne, chicory, etc.) in their tissues, rapidly turn green.

3) The parts that turn green more slowly contain little or no reserve material (leaves of pea, wheat, maize; cotyledons of castor oil plant, etc.).

In order to avoid any possible misunderstanding, the author adds that the green tinge in question is very pale and thus quite different from the green of plants grown naturally and exposed to all the daylight.

401 - **The Causes of the Elongation of the Stem of Etiolated Plants.** — COUPIN H., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 3, pp. 181-191. Paris January 19, 1920.

When a comparison is made between young plants, some grown in the dark, others in the light, the aerial parts of the latter group are green and short, whilst in the former group they are yellow or whitish in appearance and have very long stems.

This difference is generally explained by the fact that light is known to slow down growth. On examining the question more closely, it will be seen that, if light has this slowing-down effect, it could not possibly cause such great differences as those found with certain plants, such as the pea, vetch, lentil, etc., in which the etiolated stems are sometimes 10 times as long as those that have grown in the light. Evidently, there is some other factor acting as well as light. It may be asked whether the characters of etiolated plants are not due to the absence of chlorophyll and consequently, of its activity. Starting from this hypothesis, which was supported by various observations, the author carried out several experiments which apparently confirmed it satisfactorily, without, however, proving its truth.

CONCLUSIONS. — If plants grown in the light are dwarf compared with those grown in dark, this is probably due to the chlorophyll function which, by means of the chloroleucites, distributes in the plant an internal secretion which slows down growth. The author has no information as to the chemical nature of this hypothetical, probably complex substance; he can only say that it is soluble in water and not destroyed by heating to 120°C. Inversely, if etiolated plants have long stems this is because they cannot assimilate, for the double reason that they have no chloroleucites and receive no light rays.

402 - **Action of Chlorine and Different Vapours on Plants.** — GUÉRIN, P. and LORMAND, C., in the *Comptes rendus de l'Académie des Sciences*, Vol CLXX, No. 7 (February 16, 1920), pp. 401-403. Paris 1920.

From their experiments on leafy branches and particularly plants in pots, the authors concluded that most plants kept for one, occasionally 2, hours, in an atmosphere with a concentration of $^1/_{2000}$ of chlorine, palite (monochlormethyl chloroformiate), bromacetone, chloropicrin, or dichlorethyl sulphide resist the action of these substances. They lose their leaves, but new ones grow after a time, and the plant regains normal growth. The leaves are killed by plasmolysis, i. e., by protoplasmic contraction, and this takes place very rapidly with chlorine and very slowly with dichlorethyl sulphide.

403 – **Antagonistic Reactions and the Rôle of the Callus in Grafted Plants.** — DANIEL, L., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 5, pp. 285-287. Paris, February 2, 1920

More and more accurate evidence tends to show that the callus formed at point of union of the graft largely contributes to modify the biological status of scion and stock and to cause a marked antagonism even in grafts of the plant on itself, where, without it, such would not be the case. The antagonism leads to the formation of repairing organs, while the exchange of products accidentally causes various symbiomorphoses. The internal or external repairing organs may be of the pure, associate type or bring about graft hybrids produced directly on the level of the callus or at variable distances away from it.

These products are of immediate practical value. Thus, the Bronvaux medlar and *Pirocydonia Winkleri* are now used as ornamental plants; *Pirocydonia Danieli* will probably play the same rôle in fruit growing with the pear as paradise stock with the apple; in vinegrowing, graft hybrids have already proved there utility, and all their possibilities are not exhausted. There is, therefore, every reason for investigation in this new direction.

404 – **Action of Heat on Sugar-Beet Seed.** — SAILLARD (communicated by M. TISSERAND), in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 5, pp. 91-92. Paris, February 4, 1920. AGRICULTURAL SEEDS

M. TISSERAND has communicated to the Academy a note by M. SAILLARD (Director of the Laboratory of the Syndicate of Sugar Manufacturers on the experiments he carried out with M. VEHRUNG as his co-worker on the action of heat on sugar-beet seeds.

The work was done with seeds of very good, good, and medium quality, which were heated in a thermo-regulated oven, while the germination tests were made on damp sand kept at 25°C.

The seeds of each quality were respectively heated for an hour to 40°, 50°, 60°, 70°, 80°, 90°, 100°, and 105° C., then germinated at 25°C. for 22 days together with unheated, control seeds.

The following conclusions were arrived at:

1) The seed clusters of the very good seeds with a 98 % germination, and good commercial seeds with an 87 % germination, retain all their germination power when heated to 60°-70° C., as demonstrated by M. SCHRIBAUX.

2) Bad seeds with a 36 % germination, when submitted to the same temperatures, are mostly killed.

3) A temperature of 80°C., even when maintained for 1 hour, does not alter the germination coefficients after 14 days with superior quality and good, ordinary quality seeds. It only retarded germination slightly.

These experiments will be of interest to those taking part in the competition opened by the French Ministry of Agriculture for the construction of a drying apparatus for beet seed that will enable them to be kept a long time, while leaving their germinating power unimpaired.

405 – **Means for Increasing the Germinating Capacity of Camphor Seeds.** — See No. 426 of this *Review*.

PLANT BREEDING

2.01 - **The Need for Extending and Intensifying the Line Breeding of Wheat in Spain.** — Hernández D. J., in the *Boletín de la Asociación Agronómica de España*. Year XI, No. 121 pp. 101-105. Madrid, February, 1919.

After showing the insufficiency of mechanical selection, the author points out the need for intensifying line breeding in order to create types especially suited to Castile. In that country the chief quality of wheat should be resistance to drought, as this often occurs after sowing. Such selection, according to the author should be limited to the choice and isolation of a few plants that have shown a clearly super-normal resistance in particularly arid soils or in very dry years. The progeny of these plants should be kept separate, and the various pure lines should be submitted to comparative tests so as to show which lines combine the characters "specific productivity" and "resistance to drought" in the best proportions, while giving the largest yields.

2.02 - **Correlations Between Certain Characters of the Ear and the Yield of Grain in Maize.** — Beegle, H. H., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 4 pp. 201-234. Washington, September, 1919.

The five Selections 77, 100, 119, 133 and 204 were studied. Data concerning the weight and length of the ears, the numbers of rows of kernels and the shelling percentage are given in the following table:

Variety	Weight of ear in gm.	Length of ear in inches	Number of rows	Shelling Percentage
Selection 77	324	8.4	14.6	80.2 %
Selection 100	347	8.8	12.7	85.6
Selection 119	363	8.6	16.8	83.5
Selection 133	228	7.2	15.3	81.9
Selection 204	257	8.0	17.3	83.4

The biometrical data was collected from 1914 to 1918.

As a general conclusion drawn from the measurements made, a constantly positive correlation was found except in Selection 204 in 1917, between the weight of the ear and the yield. The coefficient varies from + 0.17 to + 0.865 and is thus, low on the average. There is also a positive correlation between the length of the ear and the yield, but, in this case also, there are fairly low values, ranging from — 0.11 to + 0.581 the coefficient, however, is always positive.

Some data regarding the variety Selection 119 are given below:

Year	Average length: Long ears (inches)	Average length: Short ears (inches)	Correlation: Coefficient	Increase in grain yield due to the greater length: Percentage	Increase in grain yield due to the greater length: Bushels
1915	9.8	7.0	+ 0.331	4.0 %	2.00
1916	9.8	7.7	+ 0.354	7.0 »	3.55
1917	7.9	5.1	— 0.350	18.7 »	9.35

There was no special relation between the percentage of seeds and the number of rows.

408 – **Determination of the Percentage of Cross Pollination Between the White and Yellow Varieties of Sorghum.** — KARPER, R. E. and CONNER, A. B., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 6, pp. 257-269. Washington, September, 1919.

Cross pollination is fairly common in fields of sorghum and militates against the retention and improvement of the selected types. The results are given of a series of experiments intended to establish the proportion of cross pollination under natural conditions.

Cross fertilisation observed in the progeny of white milo, growing under the best possible conditions affording maximum natural cross pollination from yellow milo.

Number of the line	Total number of progeny	Number of plants *with* yellow inflorescences	Number of plants hybrid *without* yellow inflorescences	Total number of hybrids	Percentage of cross fertilisation
1	330	10	—	10	3.03 %
3	184	21	—	21	11.41
4	154	14	1	15	9.74
11	457	13	—	13	2.84
15	70	18	7	25	35.71
23	481	27	1	28	5.82
26	990	40	2	42	4.24
30	509	12	—	12	2.35
37	153	26	2	28	18.30
41	585	39	16	55	9.40
All rows. . .	13430	788	42	830	6.18

In 1917, the author observed a certain number of white milo plants growing in a field of yellow milo. The seeds from 41 infloresences of white milo were sown separately and a total was obtained of 13,430 progeny (see Table), of which only 830 or 6.18 % show hybrid characters.

The hybridisation percentage for white plants completely enclosed in a yellow population is thus slightly over 6%. In the case of two varieties that flower simultaneously, not mixed, but sown on two adjacent plots, the percentage of cross-fertilisation could not be higher than 3%.

409 – **The Improvement of Cereals, Flax and Rye-Grass in Ireland, by Selection and Hybridisation.** — *Report of the Work of the Plant Breeding Division for* 1919, in the *Department of Agriculture and Technical Instruction for Ireland*, Vol. XX, No. 1, pp. 102-107. Dublin, 1919.

Results of selection and hybridisation work undertaken in Ireland, especially with wheat, barley, oats, flax and rye-grass.

METHOD. — First of all, those plants that showed superior characters were isolated (selection by pure lines); the progeny — mother plants, heads of lines, etc. — were grown separately and carefully examined in order to choose the best of the pure lines. Finally, the best lines were multiplied and, after a period of comparative tests, then multipied commercially, when the seed was sold to the farmers.

Besides this selection work, crossings were made between lines considered to be best suited for the creation of new varieties combining the good qualities, while eliminating the bad qualities, of the parents.

WHEAT. — Comparative tests were undertaken at the Albert Agricultural College, at Glasnevin, with the following varieties:

Yeoman, a red wheat recently introduced by Prof. BIFFEN (of Cambridge University). It was produced by crossing the high-yielding Browick Red and Red Fife, which gives good results on milling.

Hawk, red bearded; introduced in autumn, 1918; ripens rather late and is difficult to thresh.

Red Velvet, native Irish; grown in Tipperary.

Queen Wilhelmina, *White Stand-up* (both white) and *Squarehead Master* (red), all widely grown in Ireland.

Cone, produces very coarse seed, ripens late; to obtain good results it must be sown in September or in early October.

Red Fife, not a heavy cropper, but excellent for milling.

Benefactor, white, with felted and very dense ears, very subject to rust.

As regards yields of grain, they come in the following order:— *Yeoman*, *Hawk*, *Red Velvet*, *Queen Wilhelmina*, *White Stand-up*, *Squarehead Master*, *Cone*, *Red Fife*, and *Benefactor*.

BARLEY. — A large number of comparative cultural tests were carried out with *Archer*, *Goldthorpe* and with the crosses *Archer* × *Spratt* $\frac{37}{6}$ 37 and *Archer* × *Goldthorpe* $\frac{4}{5}$ $\frac{}{1}$

The best results were obtained with *Archer* × *Spratt* $\frac{37}{6}$ (widely grown on account of its evident superiority to *Archer*), both as regards yield and strength of straw.

Archer × *Goldthorpe* $\frac{4}{5}$ $\frac{}{1}$ has a wide ear, short, stiff straw and a very short "neck". Although it gave lower yields than *Archer* in all the experiments, it should not be set aside, as it gives good results where very strong straw is required. The hybrid *Goldthorpe* × *Spratt*, although free from the serious defect of *Goldthorpe*, the ear of which falls very easily when ripe, is not yet as productive, and thus leaves the way free for further improvement by means of suitable crossings.

OATS. — Pure line cultivations were made with *Abundance*, *Potato*, *Banner*, *Victory*, *Sandy*, *Island Magee*, *Black Tartary*, *Black Bell*, and *Black*

Mogul. New forms were obtained from the crosses *Black Tartary* × *Potato*, *Banner* × *Black Tartary*, *Victory* × *Black Mogul* and these are still being studied.

Numerous crosses were made during the last season between *Potato* and other varieties, in order to obtain a new variety having, in addition to the excellent tillering and milling qualities of Potato, stronger straw and an earlier ripening habit.

Flax. — A pure-line selection of the commercial variety Riga was begun in 1911. Plants belonging to different lines and coming from distinct mother plants, were at once found that showed remarkable uniformity in both their anatomical and physiological characters, e. g., tillering, vegetative vigour, resistance to low temperatures, duration of growth period, etc. Of the various lines Nos. 3 and 5 were the best and, accordingly, were propagated at Glasnevin and Ballinacurra.

In the comparative trials, plots sown with Nos. 3 and 5 were clearly better than those with the ordinary, commercial type, thanks to the uniformly equal crop. No. 5 gives a higher yield of fibre and No. 3, though producing slightly less, is more profitable owing to the better quality of its fibre. In 1913, the pure-line selections of Riga were renewed, and it was found that Nos. 2 and 6, still under trial, were apparently superior to Nos. 3 and 5 as regards length of stem.

Rye-grass. — The pure-line selection of commercial varieties of *Lolium italicum* and *L. perenne* has also been undertaken.

410 – **Determination of the Percentage of Cross-Fertilisation Between *Medicago sativa* and *M. falcata*.** — Waldron, L. R., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 6, pp. 259-266. Washington, September, 1919.

Results of researches with the aim of establishing the degree of natural cross fertilisation between alfalfa plants growing close together. The two species *Medicago sativa* (with white or blue flowers with intermediate shades) and *M. falcata* (with yellow flowers) were employed. The hybrid plants are easily distinguished from either parent by the characteristic colour of their flowers.

The two species were sown in a square plot in lines in the following order (a total of 117 plants) : —

o × o × o ×
× o × o × o
o × o × o ×

(o = *Medicago sativa*; × = *M. falcata*).

Flowering took place at the end of June and the pods formed at the beginning of August. At that time, there were found to be 10,041 and 5251 pods on plants of *sativa* and *falcata* respectively, of average growth. The seeds from 85 plants were sown separately. The appended table summarises the data relating to the progeny of the plants themselves.

Quantities of seeds produced by the parent plants and the percentage of hybridisation in the F_1 plants of M. sativa and M. falcata growing together.

	Medicago sativa					*Medicago falcata*			
No.	Seeds produced by parent	Number of plants that flowered	Hybrid plants	Percentage of hybrids		Seeds produced by parent	Number of plants that flowered	Hybrids plants	Percentage of hybrids
	Grams.					Grams.	Grams.		
1	22.8	79	4	5.06	50	4.7	96	54	56,25
2	20.1	7	0	0	51	1.4	88	44	50,00
3	18.4	73	5	6.85	52	1.0	30	15	50.00
4	20.1	36	2	5.56	53	1.4	41	24	58.54
5	40.7	82	6	7.32	55	3.5	76	40	52.63
6	36.9	79	9	11.39	57	0.9	56	13	23.21
7	28.8	73	3	4.11	59	1.8	49	18	36.73
8	26.0	82	5	6.10	62	0.9	27	7	25.93
9	11.2	68	2	2.94	63	2.3	75	33	44.00
10	38.1	96	4	4.17	64	3.3	74	38	51.35
11	18.0	79	13	16.46	65	2.9	44	17	38.64
12	27.3	74	4	5.41	66	7.8	74	16	21.62
. . . . .									
36	37.9	82	4	4.88	85	4.2	75	28	37.33
Totals	647.1	2099	157	223.53	—	90.8	1862	795	1170.07
Averages	22.3	—	—	7.48	—	3,2	—	—	42.70

The percentage number of plants with hybrid characters was very low with *M. sativa* and high with *M. falcata*. The explanation of this is that the latter species has fewer flowers and less pollen than the former.

The coefficient of correlation existing between the percentage of crossing and the yield of seed has been calculated by the author, and, although it is very low (*M. sativa* $= -0.14 \pm 0.12$; *M. falcata* $= -0.2 \pm 0.12$) it is always negative, thus confirming the possibility that this correlation does exist.

411 – **On the Need for the Selection of Turnips in New Zealand, in Order to Obtain a More Uniform Product.** — Bruce, L. E., in *The New Zealand Journal of Agriculture*, Vol. XIX, No. 5, pp. 284-287. Wellington, November, 1919.

From many cultural tests of the Champion, Elephant and Superlative varieties of turnip, it was found that morphological deviations from the type are common, these being found even in specially selected varieties furnished by leading European houses.

It is certain that selection carried out in the New Zealand Experiment Stations would give excellent results. But, if it is to be possible, it is neces-

sary : — 1) to produce pure varieties, which requires the help of specialists ; 2) to have an organisation by means of which the selected types could be propagated and kept pure, which requires Government help.

The following plan should be followed : —

First year : From, the original selection A is obtained the product A_1, which is cultivated at the plant-breeding station for its seed. All inferior or aberrant plants must be rejected.

Second year : The seed from the previous year is divided into two A_2 and B. Lot B is sold to farmers for the production of the seed they require ; Lot A_2 is still cultivated at the plant-breeding station for the production of pure seed. All inferior plants are rejected.

Third year : I) The seed from A_2, is divided into two lots : A_3 and I B ; A_3 is keptat the station in order to continue the type, I B is sold to farmers who undertake to produce the seed only. II) The seed from B $(= B_1)$ is distributed and sold for root production.

Fourth year : I) The seed from A_3 is divided into two lots, of which A_4 serves to preserve the type and 2 B is sold to farmers who undertake to produce seed only. II) The seed from I B is sown and the seed it produces (I B_1) is sold for root production. III) The seed from B_1 $(= B_2)$ is used for ordinary owing.

At present, the seed produced in New Zealand corresponds to B_2 and gives rise to F_4 products that escape the control of selection for successive generations. On this account, it is not to be wondered at if the crop, instead of being uniform, consists of a product mixed with aberrant or degenerate types.

This shows the need for the institution of pure line selection and the author suggests that a special organisation and plant-breeding stations should be provided in New Zealand.

412 - **Degeneration in the Sugar-Beet and its Remedy in Selection.** — Cassel, L., in the *Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie*, Vol. XXXVII, No. 4, pp. 131-140. Paris, October, 1919.

The flowering of the sugar-beet in its first year of growth is equally harmful to the grower, whose crop is reduced, and to the manufacturer as his root cutters wear out more rapidly. This anticipation of the flowering period has been explained by reference to heredity, but this is improbable because the sugar-beet is the product of long and careful selection, during which any suspected plants are rejected.

Commercial seeds come from parents and ancestors that have been rigorously controlled for a relatively long period (8 or 10 years). If heredity is excluded, then the problem of atavism comes in, seeing that cultivated selected plants tend, when the modifying action ceases, to return to the primitive type. In a wild state, beet is an annual plant, and it is only by means of prolonged selection that it has been possible to obtain the cultivated type which, during the first year, can store up the reserves which will enable it to grow and produce seed during the second year.

The tendency of the beet to " bolt " during the first year is, therefore,

probably a sign of reversion to the primitive type and a symptom of degeneration in the selected type.

In considering the causes that favour this process of degeneration, the author suggests that a plant submitted during its early growth to contrary conditions of soil and climate, which diminish its vitality, has a marked tendency to premature flowering. The author illustrates his theory by a number of examples taken from flower and fruit growing.

It is known that beets sown early give a higher percentage of " bolters " than beets sown later (normally). In the second case, the temperature is very high at sowing time, with the results that germination takes place rapidly and is complete in 10 to 12 days. Under these conditions the young plants are healthy and strong, remaining so up to an advanced stage of growth and accumulating large amounts of reserve material without flowering. On the contrary, if they are sown very early, they usually have to face cold and damp weather, germination is delayed, the early growth is weak and slow, and the plant, on the return of favourable growing conditions, tends to close its vegetative cycle prematurely as if, influenced by previous adversity, it feared to meet some new obstacle opposing the final act of reproduction of the species. Having gone so far, it now becomes a question either of abandoning early sowing or of submitting to the losses caused by bolting.

Besides the advantage consisting in the better distribution of the work, early sowing also leads to a greater production of sugar. Plants produced by early sowing, if not too injured by cold during their early growth, have attained, by the season of " second " heat, a development that enables them better to resist drought. In fact, the well developed roots penetrate to depths where the soil has most moisture and provide the plant with sufficient water to compensate for transpiration. If " bolting " can be avoided, the weight of roots and the sugar content will be greater.

The following measures are recommended in order to avoid the bad consequences (bolting) of early sowing : —

1) Decortication of the seed, to facilitate germination.

2) Shallow sowing, to aid emergence.

3) Keep the soil loose the young plants to emerge, without. however, breaking the surface layer up too much, as fine soil easily cakes under rain and thus prevents the young plants from coming up.

4) Avoid premature thinning that would expose the isolated and still tender plants to a return of cold weather.

5) The best method certainly consists in selection and crossing. carried out in such a way as to produce new types that resist cold and consequently capable of growing even under unfavourable conditions of temperature.

413 – **Geographical and Taxonomic Researches undertaken in Order to establish a Rational Basis for the Selection of Tea.** — COHEN, S. C. P., in the *Department van Landbouw Nijverheid en Handel-Lands Planetuin. Bulletin of the Botanical Garden of Buitenzorg*. Vol. I, Pt. 4, pp. 1-320 18 Figs. Buitenzorg, 1919.

After summarising previous work done in Java on the improvement of tea, the author deals with the question of a vast programme of research

which includes a detailed study of the many varieties of tea, the object being the establishment of a sound basis for work from the standpoint of genetics and selection.

The first chapter deals with tea-growing in Java (1) and British India, the second with tea-growing in China and the adjacent countries (especially in Indo-China (2)) the third is concerned with the origin of the tea plant, and the fourth relates to a systematic study of the genera *Camellia* and *Thea*, a genealogical tree and key being given for the identification of the various species. The fifth chapter treats of common tea (for which the author proposes the name of *Camellia theifera* (Griff.) Dyer) ; the following varieties and races, known in India and China, have been described in detail after a careful examination : —

I. — Variety *viridis* Watt. — *Race* 1, *native to Assam* : bush or small shrub with leaves 10-17.5 cm. long and 5-7 cm. wide, with ovate-oblong, pointed, thin almost, membranous blades, and 16 chief veins ; intermediary tissues thin, wrinkled, pale green in colour, highly vascular. The lower surface is rough to the touch owing to the presence of numerous warts (protrusion of the epidermal cells at the base of the hairs). Inflorescence nearly always solitary. Numerous varieties are derived from this race ; it is grown the most and spoken of as the best of all the types of tea in India.

Race 2 : *Lushai*. — In shape resembling a small tree like the poplar and from 50 to 60 ft. high. When full grown, its leaves are, on an average, 20-35 cm. long and 10-15 cm. wide. Of all the known races of tea, this has the largest leaves and, in this respect, it is much superior to the Chinese types. The blades have from 22-24 chief veins ; the structure and characters of the epidermis are the same as those of native Assam tea. *Lushai* is cultivated over small areas in Sylhet and Chittayong and is apparently a local form derived from wild plants.

Race 3 : *Naga*. — Bush with open, upright habit. Mainly grown round Pherima, at an altitude of 1950 ft. Leaves with very elongated blades from 10-22.5 cm. long and 5-7.5 cm. wide. As regards structure it is very similar to Assam tea, with which it is easily crossed, producing numerous hybrid forms.

Race 4 : *Manipur*. Wild tea growing in the Manipur forests. Transported to Cachar, Sylhet and even Annam, it is now grown over a very large area and has often been crossed with other races. Manipur tea is characterised by the width of its almost elliptical leaves : blades 15-20 cm. long, 6.2-8.7 cm. wide. Leathery structure ; dark green colour ; few but evident veins.

Race 5 : *from Burma and the Shan States*. — These are little-known and ill-defined types that form a group blending on the one hand with the

(1) For tea-growing in Java, see *R.*, Feb., 1920, No. 209.

(2) For Indo-Chinese tea, see *R.*, Nov. 1918, No. 1243 ; *R.*, April, 1919, No. 467 ; *R.*, May, 1919, No. 601. and No. 427 of this *Review*. (*Ed.*)

Manipur race and on the other with the Yunnan race. The leaves, clearly elliptical in shape, are smaller and coarser than Manipur leaves.

Race 6 : *Yunnan and China.* — Owing to the lack of data, a classification like that for India cannot be established. Open bush found growing in forest shade, i. e., under the same conditions as true wild tea in India. The leaves are 11-12 cm. long and 4-5 cm. wide.

II. — Variety *bohea.* — Fine-loking bush, much ramified, mostly found in India as a cultivated plant. Leaves of medium size, linear, oblong, thick, coriaceous, smooth, often folded along the length of the upper face (which makes the blades concave instead of convex, as in native Assam). There are 10-15 chief veins ; the lower face of the blade is covered with spots resembling small shining scales.

III. — Variety *stricta.* — Small, much ramified shrub, never over 60 cm. in height. Found frequently at Darjeeling, Kumaou, Kangra, in the Nilghiri Mountains region, in some parts of Upper Assam and even, which is worthy of noting, in China. Small, linear, smooth, thick, coriaceous, leaves, with indistinct network, and 4 chief veins (sometimes 6, rarely 8). Their length varies from 2.5-6 cm, and their breadth from 1 to 2 cm. But, in many cases, the tree as well as its leaves, has smaller dimensions. There is a specimen in the Kew Herbarium which measures in all, roots included some 10-15 cm., in length and the leaves are reduced to 1.25 × 0.60 cm. The same small spots are present on the lower face of the leaves of the variety *stricta* as in the variety *bohea.* This peculiarity, common both to *stricta* and *bohea,* distinguishes them from all the other races of tea and suggest that they are derived from a cross between forms with larger leaves.

IV. — Variety *lasiocalyse.* — Much branched shrub, with abundance of oblong, pointed leaves, cuneiform at their base; dimensions 2.5-5.0 cm. × 1-2 cm. ; thick, large leaves, of a pale lemon colour when dry ; almost glabrous, except for a few trichomae on the lower surface near the central nervure. Compact inflorescences with 3-5 flowers, very short peduncles, and 2-3 bracts ; calyx formed of two whorls of small rounded sepals, more or less hairy, and brilliant red in colour. The author thinks that the variety *lasiocalyse* is derived by mutation from a type with glabrous leaves.

Indian and China tea. — According to the author, Assam tea, discovered in 1835, is more similar to the races from Burma, the Shan States, and Yunnan, than the large-leaved Manipur and Lushai types. The author also mentions the two races of tea, one with small and one with large leaves, discovered by Eberhardt at Tonkin, on the heights of Tani-Dav, and, after reviewing all the types described by Watt, he discusses the value of the species and varieties of *Thea sinensis* described by Linnaeus and quoted by Loureir, Salisbury, Von Siebold, Masters, Pierre, and J. Kochs.

A collection of such important, though sometimes ill-defined, material offers notable difficulties to classification. According to Watt, there are 2 chief varieties : var. *viridis* Watt, with large, glabrous leaves and var.

lasiocalyse Watt (or var. *pubescens* Pierre), with hairy leaves, rather rare and chiefly known in the peninsula of Malacca. All the other forms and varieties found in the plantations, then, would be derived by crosses between the two fundamental types :

1) *viridis* × *lasiocalyse* = *stricta ?*
2) *viridis* × *stricta* = *bohea.*
3) *viridis* (Manipur) × *stricta* = Ceylon hybrid.

Various forms of leaves of tea in a " population ".

But this interpretation is not completely, satisfactory to the author, who is inclined to believe (see above) that *lasiocalyse* was procuced by mutation from a form with glabrous leaves, Yet, however complicated and difficult the problem of a final classification may be, if the characters of shape and colour are taken as a basis, the existence could not be denied of a substantial and profound difference between the two extremes of small-leaved China tea and large-leaved Indian " Lushai " tea. These two types can be characterised in the following way :—

China tea	*Indian tea*
1) Small shrub.	1) Tree with spreading crown.
2) Early and numerous flowers.	2) Late and scanty flowers.
3) Leaves rarely measure more than 9 × 3 cm.	3) Leaves usually measure more than 12 × 4 cm.
4) 8-10 pairs of lateral nervures.	4) 10-14 pairs (up to 22) of lateral nervures.
5) Usually more than 30 teeth.	5) Usually less than 30 teeth.
6) Leaves generally reddish towards the tip.	6) Leaves usually green or yellowish-green towards the tip.
7) Leaves usually smooth.	7) Leaves often rough.

CULTIVATED TEA. — There is no doubt that there are two distinct races of tea — Chinese and Indian. The difficulty begins when it is attempted to establish the taxonomic position of the intermediate forms, which are also the commonest. Instead of undertaking this apparently unending analysis, the author prefers to group all the cultivated types that furnish " tea " under one species. This apparently is equally satisfactory to practical requirements. In fact, the commercial types are far from belonging to well defined varieties, but they constitute a mixture of forms that are often very different one from another, (see appended illustration) and it will eventually be more satisfactory to distinguish by a statistical method rather than by a botanical classification.

As regards the rules to be applied to the identification of this collective species, the result of the critical examination of the various systems of nomenclature taken into consideration may be summarised as follows : —

1) The generic term *Thea* should be rejected ; *Camellia* is the only correct name.

2) *Thea sinensis* (L.) Sims., is out of date, whereas *Camellia sinensis* (L.) O. K. is in accordance with the international rules ; again the name given by LINNAEUS (1753) does not include Assam tea.

3) *Camellia Thea* (Link) Brandis., should be excluded ; the Indian and Chinese types have already been united under a single species — *C. theifera* (Griffith) Dyer.

4) *C. theifera* should be used in preference to *C. sinensis*.

The author, therefore, proposes to unite all the cultivated forms of tea under the collective species *Camellia theifera* (Griffith) Dyer.

414 - **Improvement of Coffee in India, by Selection and Crossing.** — ANSTEAD, R. D., in *The Agricultural Journal of India*, Vol. XIV, Pt. IV, pp. 639-644. Calcutta, July, 1919.

Since the possibility was shown by CAMERON, in 1899, of considerably improving coffee by selection and hybridisation, much work has been done with the object of forming a new type of ordinary *Coffea arabica*, that would be more productive and disease-resistant.

Good results were obtained in various localities, particularly in South Mysore by CRAWFORD, in Chundrapore by HAMILTON, and in South Coorg by JACKSON ; they succeeded in producing several excellent and completely stable hybrids, whose seeds will shortly be put on the market. The author

points out the need for establishing a special station for the selection of coffee, provided with a special expert staff.

So far, however, this work has not had the slightest influence on the methods of cultivation in use on the plantations. The way the seed destined for the nurseries is gathered, without any attempt at selection, cannot but harm the varieties and lead to their degeneration, as has already been found in several localities in India.

The first principle of selection should be to choose the best tree on the estate, which should be characterised by uniform growth, an abundant and good-quality product, even under unfavourable weather conditions, and by immunity to disease and a high degree of resistance to insect attack.

The best plants chosen in this way should be completely covered by a net at flowering time, to avoid chance fertilisation by strange pollen, the net being held down by earth and strengthened by a border of strong cloth. This isolation ensures self-fertilisation, but decreases the percentage, of seeds set; this difficulty might be avoided by allowing insects such as bees to swarm under net. In any case, the quantity of seed obtained is sufficient for the establishment of nurseries and the method has the advantage of producing plants that completely resemble the parent tree.

As soon as setting has taken place, the net can be removed, and the fruits are removed when completely ripe. The seeds are rigorously selected, and the best ones sown in nurseries; the young plants that result are carefully examined, any weakly or badly developed plants being rejected before transplanting takes place. When these selected plants begin to produce, 3 or 4 of the best are chosen and isolated in the manner described above.

Thus, in 10 or 20 years, simply by selection, vastly improved types can be obtained that are much superior to the original variety. Besides this improvement, on account of the lack of genetic uniformity in the original varieties, which are more like mixtures or populations, stable varieties can be obtained, or rather isolated, that show distinct differences.

As regards crossing, JACKSON obtained a hybrid of *arabica* at Dubarri. This was a true hybrid of very vigorous growth, which is disease-resistant and comes into bearing early (in the second year). In September, 1918, the first plantation (about 23 acres) of this hybrid was made at Malamby; by the end of the first year, the plants were already from 3 to 6 feet in height. The great uniformity, vigorous growth, productivity, and resistance to disease of this hybrid make it a remarkable type, that will certainly be justly esteemed on the market.

415 – **Influence of Foreign Pollen on the Shape of the Fruit of the Mother Plant in Certain Crosses between Vanilla planifolia and "Vanillon".** — MAC CLELLAND, C. B., in the *Journal of Agricultural Research*, Vol. XVI, No. 9, pp. 245-251 + Plates 31-35. Washington, March, 1919.

For some time, experiments have been undertaken at the Mayaguez Agricultural Station with the object of developing the cultivation of vanilla on a large scale at Porto Rico.

Careful studies of pollination, fertilisation, growth, and the characters of the fruit have been, and are still being, made. Two types of vanilla are of economic importance to the island :—

1) *Vanilla planifolia* with thin, elongated pod of excellent quality, and 2) " Vanillon ", thicker snorter pod of very inferior quality, but which, even when quite ripe, can remain attached to the plant without opening, which is of considerable advantage.

The results are given of a series of reciprocal crosses between *V. planifolia* and " Vanillon ", especially as regards the immediate influence of foreign pollen on the shape of the fruit of the mother plant, an influence that can be studied and determined.

The typical self-fertilised fruits of *V. planifolia* are elongated capsules that narrow gradually towards the peduncle, and retain their thickness almost to the tip, which makes them club-shaped.

The name " Vanillon " includes all the varieties or species of vanilla that do not belong to *V. lanifolia* and which are generally characterised by large yellow flowers, whereas *V. planifolia* has greenish-coloured flowers which are not very obvious. Vanillon fruits have a uniform diameter all along their length, save at the ends, where the sudden blunting gives them their truncated, squat appearance.

If the pollen of *V. planifolia* is placed on the stigma of Vanillon and *vice versa*, the fruits obtained are modified, showing the influence of foreign pollen. So as to find the biometric characters of the shape of the fruits, the author measures them in two places : 1) at a distance of 2.5 cm. from the tip ; 2) at a distance of 3.7 or 2.5 cm. from the base or the insertion of the peduncle.

In the pollination experiments, the author used *V. planifolia* and many varieties of Vanillon, Viz., V 13 from Guadeloupe ; V 34, V 43 and V 52 from Panama ; V 62 from Mexico.

I. — *Vanilla planifolia* ♀ × *V. planifolia* ♂ : the circumference of the fruit at 1 inch. from the base is less than the circumference at 1 $^1/_2$ inches from the tip ; in other words, fruits that are thin at the point of insertion become club-shaped at the tip ; the following averages are based on 23 determinations : —

1) Length of fruits : from 6 $^1/_2$ to 9 $^3/_4$ inches.
2) Average circumference at 1 $^1/_2$ inches from the base : 1.3 inches.
3) Average circumference at 1 inch. from the tip : 1.66 inches.

II. — *V. planifolia* ♀ × Vanillon ♂ : the data for 7 out of the 20 measurements carried out are given in the following table : — (see pag. 449)

The circumference of the fruit, at 1 $^1/_2$ in., from the base, is greater than that at 1 in. from the tip by 25.1 %. The averages from 20 measurements are : —

1) Length of fruits : from 6 $^1/_2$ ins., to 9 $^3/_4$ inches.
2) Average circumference of fruit at 1 $^1/_2$ ins., from base : 1.7 inches.
3) Average circumference at 1 in. from tip : 1.38 inches.

Variety supplying pollen	Length of fruits	Circumference of fruit at 1 ½ ins. from stem end	Circumference of fruit at 1 in. from tip
	inches	inches	inches
V52.	6 1/2	1 56	1.1
V34.	6 3/4	1.6	1.25
V52.	7	1.5	1.1
V62.	7 1/2	1.8	1.3
V34.	8	1.87	1.3
V52.	8 1/2	1.6	1.5
V52.	9	1.8	1.6
Averages for 20 varieties	—	**1.7**	**1.38**

III. — Vanillon ♀ × Vanillon ♂. At 2.5 cm. from the two ends, the fruits have practically the same circumference. The data from 54 measurements are : —

1) Length of fruits : from 3 to 7 1/4 ins.
2) Average circumference at 1 in. from base : 2.46 ins.
3) Average circumference at 1 in. from tip : 2.45 ins.

IV. — Vanillon ♀ × *Vanilla planifolia* ♂ : the circumference at the tip is 28.2 % greater than that at the base ; hence the club shape. The averages from 23 measurements were :—

1) Length of fruits : from 2 3/4 to 5 1/2 ins.
2) Average circumference at 1 in. from base : 2.05 ins.
3) Average circumference at 1 in. from tip : 2.6 ins.

It is evident that foreign pollen modifies the shape of the fruits on the mother plant.

The structure of the flowers of these two types of vanilla offers a plausible explanation for these facts. At flowering time, the ovaries are practically the same length in both types, whereas the style of Vanillon is much longer (from 60-70 %) than that of *V. planifolia*. When the pollen of the latter is placed on the stigma of Vanillon, it can hardly force its pollen tube to the base of the ovary ; in any case, the number of ovules fertilised would be greater towards the tip than at the base of the ovary, hence the club shape of the fruit.

The pollen tubes of Vanillon, when placed on the stigma of *V. planifolia*, have a shorter distance to traverse to reach the ovary than they would ordinarily have in their own flowers, in which the style is longer. A large part of the ovules (placed at the summit of the ovary) of *V. planifolia* would not be fertilised by the Vanillon pollen, whose germination tubes reach the bottom in attempting to reach a point corresponding to the normal distance between the stigma and ovary of Vanillon. There results more abundant fertilisation at the base of the ovary and consequently, the number of seeds diminishes progressively towards the summit, for which reason the fruit gets gradually thinner towards the tip, which is partly empty.

CEREAL AND PULSE CROPS

416 – **Experiments on Wheat Growing in Tonkin.** — Miéville, R., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, pp. 364-369. Saigon, December, 1919.

For some years, wheat growing has been attempted in various parts of Indo-China, especially in Tonkin. The experiments have been carried out on the delta and on plateaux of varying height, but, up till recently, the results have not been very encouraging.

At Trau-Ninh (Tonkin), in 1904, 1905 and 1906, the Agricultural Station situated near Xieng-khouang, at an altitude of about 4000 ft., carried out experiments in growing cereals (wheat, rye, oats, barley), but without satisfactory results. In the first series of experiments, carried out in the rainy season, the following varieties of wheat were grown : — Hard Medeah Spring Saumur, Bordeaux, and Bearded Hérisson. Sown at the end of April (1904 and 1906), or on July 10. (1905), these wheats produced no seed. This failure is due to the special conditions of the climate.

The fairly frequent rains at Trau-ninh did not cause any rotting of the stool of the wheat, but, on the contrary, aided tillering, though at earing time the stems were weak and scanty. Flowering is fatally deficient, as the pollen is washed away by the rain, so that fertilisation is not brought about. This is why the first experiments should have been directed to finding the best times for sowing. On account of these negative results, the experiments were suspended for a long time.

The author took up the work again in the autumn of 1917, with the following varieties : Early Richelle, Red Touzelle de Provence (French wheats), Caobang (Tonkin) and Red Yunnan (China).

The Caobang wheat was sown on November 21-24, 1917 ; the seed had a poor appearance and a very slight weight. The plants came up on November 27-30, earing took place on February 25, flowering on March 10, and the harvest on May 1. The straw, which was fully grown, was 1.2 metres high and the crop was 90 kg., or 22.5 times the weight of seed used (4 kg.). As may easily be understood, Caobang wheat is far from being genetically pure, but it can be considered as a mixture of different forms. Thus, as regards the characters of the ears, one-third was bearded and two-thirds were not. Tillering was normal and the straw, although weak did not lodge.

The quality of the seed obtained was much better than that of the grain sown, the weight of 100 grains of the former being almost four times that of 100 grains of the latter.

The European wheats did not give such good results as the Caobang wheats, but the experiments did not exclude the possibility of finding, among the very early European wheats, a few types that might do well under the particular climatic conditions of Tonkin.

The author considers that Yunnan wheat is the origin of Caobang wheat, carried to Tonkin by caravans coming from the adjacent Chinese province.

Beside the improvements that could be obtained by selection, the chief object in any case should be to adapt the crop to the climate, and from this point of view, two lessons may be learned from these experiments :—

1) Sow in the second week in August, so that the young plants, profiting by the last rains, can attain a good root development, which in turn assists tillering.

2) In the choice and period of cultivation, as in the creation of types of wheat, care should be taken that the flowering period coincides with a dry spell.

417 – **Green Manures in Old Rice Fields.** — Novelli N., in *Il Giornale di Risicoltura*, Year IX, No. 10, pp. 155-157. Vercelli, October 31, 1919.

As a rule, fertilisers produce an increase of yield in rice fields, but the crop does not always respond completely in old, stable rice fields. Although continually submerged, rice-field soil thus needs special physical and mechanical conditions for it to make best use of the accumulated chemical fertility. This explains the good effect of manuring, even with straw manure, and of green manures. In this case, leguminous green manure with phosphatic fertilisers constitutes the ideal manuring, and the leguminous plant which, owing to its adaptability and its early growth, gives the best results, is crimson clover.

Numerous practical observations carried out under varying conditions have led the author to believe that physical and mechanical conditions of the soil may be much improved by the use of crimson clover as a green manure. In fact, crimson clover, with its rather rigid, strawy, almost siliceous stems, decomposes much more slowly than the other green manures when dug in, and, consequently, its physico-mechanical action on the soil is much more lasting. Again, there is good reason to believe that straw not only leads to a much greater aeration of the soil, but also prolongs it when the soil is submerged.

418 – **Cultural Experiments with *Phaseolus acutifolius* var. *latifolius* in California.** See No. 385 of this *Review*.

419 – **Manurial Experiments with Lucerne in the United States.** — See No. 397 of this *Review*. FORAGE CROPS

420 – **Potato-Growing Experiments in England.** — I. Chittenden, F. J., Effect of "Place" on Yield of Crops in the *Journal of the Royal Horticultural Society*, Vol. XLIV pp. 72-74 + 2 Pl. London, May 1919. — II. Potato Experiments at Wisley, 1917, *Ibid*, Vol. XLIII, Pt. 1, pp. 114-129. May, 1918. — III. Wilson, J. and Chittenden, F. J., Some Further Experiments with Potatoes, *Ibid.*, Vol. XLIV, pp. 83-88. May, 1919.

I. — Effect of "place" on unit yield. — The observations made by the author on some experimental plots at Wisley, England, in the garden of the Royal Horticultural Society, show that the place occupied by a plant is an important factor in the yield of potatoes and should be taken into consideration when the comparative yields from different plots are calculated.

"Up to Date" potatoes were planted in 8 pairs of plots, forming 2 parallel series of 4 pairs, each plot having 3 equidistant lines and containing 18 equidistant plants. The pairs of plots were so arranged that each external line was 4 or 5 feet away from the external line of the adjacent pair.

The two series of plots were sufficiently separated from one another so that the plants at the ends of the internal lines were freely exposed to the sun on one side, while the plants at the ends of the external lines were freely exposed on both sides.

Taking the total production of the internal lines as 100, the average results for the 3 lines on all the plots were 100 : 72 : 72. The yield from the plants on the ends of all the lines compared with the average yield of the other plants of the same line was as 100 : 82. The average yield from the corner plants was as 100 : 66 compared with that of the other plants at the end of the line, as 100 : 79 compared with the other plants of the outside lines, and as 100 : 57 compared with the plants inside the plots.

The conclusion is that the best place is at the outside corners, followed by the outside lines, then the ends of the inside lines, whilst the worst place of all is on the inside lines.

II. — Experiments with potatoes at Wisley in 1917. — Descriptions are given of large-scale trials with varieties resistant to wart disease (*Chrysophlyctis endobiotica*); observations on: *a*) the effect of cutting seed tubers; *b*) the effect of covering the cut surface with various subtances; *c*) the comparison between the seed tubers whether green or not, with a varying number of sprouts already developed and seed brought straight from the store; *d*) the effect of planting tubers at different distances and on different dates.

The Aberdeen and Great Scot varieties showed a marked resistance to wart disease.

Splitting the tubers gave a small yield per plant but a much greater yield for a given weight of seed, so that this practice is suitable if little seed is available for planting, or if its price is very high.

Among the substances used to cover the wound made by splitting the seed, so as to avoid loss by evaporation as far as possible, gypsum gave the best results.

The practice consisting in sprouting the tubers before planting gave an increase of crop amounting to 2 tons per acre, as an average of all the varieties tested.

Sprouting in the light was better than in the dark. Two eyes should be left on each tuber. Tubers weighing from 2 to 3 ounces gave much bigger yields than tubers weighing an ounce.

As regards the distance between the drills, the greatest yield per unit of area was obtained with the closest planting.

The best results were obtained with tubers planted close together at the end of April.

III. — New experiments on potatoes. — The authors carried out experiments at Wisley, in 1918, on the effect of the distance, between the plants and the use of seed of various origins on the yield in tubers. The distances used were 18, 24, 30 and 36 inches between the rows and 9, 12, 15 and 18 inches in the drills. It was found that, with the Arran Chief variety, the best spacing was 24 to 30 inches between the rows and 15 inches between the plants.

In the experiments comparing local seed with seed from Scotland o Ireland, it was found that the former gave the best results. Although all the factors of maximum productivity for potatoes are by no means known, yet it is certain that one of the most important factors is the origin of the seed.

421 – **Cultivation of Sisal in Mysore, British India** (1). — CHATTERTON, A., in the *Mysore Economic Journal*, Vol. 5, No. 4, reproduced in the *Tropical Agriculturalist, Journal of the Ceylon Agricultural Society*, Vol. LIII, No. 6, pp. 380-385. Peradeniya, Ceylon, December, 1919. FIBRE CROPS

The author observes that various species of *Agave* grow quite luxuriantly in the State of Mysore. From their leaves are extracted aloes fibres, used for making rope and string, but the industry is a domestic one supplying local needs only. The extraction of the fibre is difficult, as the leaves contain a corrosive juice and the operation is painful. There are machines that extract the fibre, but they are costly and require considerable power to work them, so that they are out of the reach of most cultivators. In addition, it is unfortunate that the species of *Agave* so far introduced into Mysore, where they grow so well give a poor yield of fibre of low commercial value.

Attention is directed to the importance of sisal (*Agave rigida* var. *sisalana*), which is grown over vast areas in Yucutan, Florida, the late German East Africa, etc., and to a certain degree, in various parts of India. This species gives a good yield of a fibre much in request for rope making. Sisal was introduced into Mysore by Mr. RICKETTS, in 1892, since when it has been cultivated over a large area at Lal-Baghe, in Bangalore, from whence large numbers of young plants have been sent to different parts of India. In Mysore, no practical results of importance have resulted from the introduction of this fibre, but a small plantation of it was sucessfully cultivated sometime ago.

In 1914, the author drew attention to the possibilities of Mysore as regards sisal, but his advice was disregarded. Since then, he has paid more attention to sisal growing, with the result that he is more than ever convinced that Mysore has very great possibilities in this connection.

Sisal should only be grown on stony or gravelly soil unsuitable for any other crop. In addition, rich soils lead to an excessive development of the fleshy, succulent parts of the leaves to the detriment of the quality of the fibre. The best fibre is obtained from gravelly limestone soils of medium quality. Fertilisers are not required, and once the plant has taken root, no further attention is needed and the cost of cultivation is negligible. The extraction of the fibre by hand is difficult, but it is easy if special machines are used.

The author, in dealing with the conditions under which sisal grows, states that the chief reasons why the cultivation of this plant has not developed in Mysore are as follows :

(1) Compare the work of Messrs. CHEVALIER and VERNET, on *Agave Cantala* in Indo-China, in *R.*, February, 1920, No. 203. (*Ed.*)

1) Six years are required between planting and harvest.

2) The extraction of the fibre by hand is impossible from the commercial point of view.

3) Mechanical extraction implies working on a large scale and, consequently, necessitates a large capital in machinery and plant.

4) There is no local market for the fibre, and any export order would require large amounts of this material.

But similar objections hampered the development of tea and coffee growing, and the establishment of the tea industry in India was largely due to Government efforts. The tea and coffee industry were, and still are, controlled by European colonists, although, there is a marked tendency towards the development of the native plantations in Assam as regards tea, and South India as regards coffee. It is to be hoped that sisal growing will, as far as is possible, be developed by the native cultivators, while ensuring them a fair share of the resulting profit.

The Mysore Durbar derives a large revenue from mineral resources and the sale of electric power used in the gold-mining regions. But, sooner or later, this source of revenue will vanish with the exhaustion of the gold mines, and it would be wise immediately to create new sources of revenue. Electric power would be available for new industries, such as that of sisal, that might be established in the country.

The Government and the public authorities of Mysore should pay attention to these suggestions and start sisal growing in the State on their own initiative, by such procedures as concessions of land for a seven-year period, facilities for payment, provision of plants, establishment of nurseries, etc. In conclusion, the author studies the question from the economic point of view.

422 – ***Bombax buonopozenze* var. *Vuilletii*, a Variety of Kapok New to Science.** — PELLEGRIN, in the *Bulletin du Muséum national d'Histoire naturelle*, No. 5, p. 379. Paris 1919.

The author announces a new variety of kapok from the Sudan, the fruit of an hour-glass shape, having been sent him in July, 1914, by M. VUILLET, Director of Agriculture of Upper Senegal-Niger. Of the two parts of the capsule, the lower one is spherical and the upper one tapering at the base which fits in the calycinal cupule; if the strangulation is too great, the terminal part of the fruit sometimes aborts, but it usually develops to the same extent as the lower part, and produces normal seeds. The author has given this variety the name of *Bombax buonopozense* P. Beauv. var. *Vuilleti*.

PLANTS YIELDING OILS, DYES, TANNINS, ETC.

423 – **Studies on the Oil Palm Kernels and Palm Oil in West Africa** (1). — I. HOUARD, Etude sur l'exploitation industrielle du palmier à huile, in the *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, 1919, No. 5, pp. 173-202. Paris, 1919. — I. BAILLAUD, E. and STIELTZES, A., Les amandes et l'huile de palme, preparation, commerce, industrie. — The Enquiry of the English Oil Seeds Committee, published by the *Institut Colonial de Marseille*, XXIV + pp. 346 + Figs. Marseilles, 1920.

I. — *A*) ON THE POSSIBLE OUTPUT OF PALM OIL AND KERNELS FROM DAHOMEY. — *Economic importance of the oil palm.* — The oil palm

(1) See *R.*, July-September, No. 888. (*Ed.*)

(*Elaeis guineensis*) is one of the chief sources of wealth in Dahomey ; in fact, the customs statistics of the colony show that palm oil and kernels constitute about nine-tenths of the total exports, the value, in 1912, amounting to 19 759 739 francs out of a total of 21 318 505 frs., and, in 1918, 25 879 717 frs. out of a total of 28 723 143 frs.

No matter what future importance may be assumed by the exploitation of " karité " the cultivation of kola, cacao and cotton, the improvement in the utilisation of the oil palm will leave it supreme in the economic value of the colony.

Distribution of the oil palm. — The oil palm grows wild throughout Lower Dahomey, probably having escaped from the ancient forest, though, in many cases it has probably been planted by human agencies.

Dense stands occur in the zone between the shore and the seventh degree of north latitude. A fairly clear demarcation is found in the marshy part of the Lama, which separates the area of the really wild palms from that apparently planted by man. To the north of the seventh degree, the stands become more open and less extensive, save in certain regions in the circles of Abomey, Zagnanado and Hollidje. After 7.3°, there are only occasion clumps in damp spots and the palms are weakly, with elongated stipes and scanty foliage, while fructification is very scanty and irregular ; in this area, it will be replaced by karité which is better adapted to the continental climate.

The presence of dense stands in Lower Dahomey corresponds fairly accurately with the geological distribution of the different soils. The most suitable soils are those derived from the river bars and damp alluvia, on account of their power to retain moisture.

The most important oil-palm zone, therefore, includes most of the land between the sea and a parallel line passing above Zagnanado.

Importance of the stands. — The dense stands are not far from the coast and they have the advantage of having the railways, rivers, lakes and lagoons at hand for communicating with the large buying centres or ports. These are the only stands of commercial and industrial interest, the small stands in the north being of no importance. These stands can be divided into two groups :

1) Lower Dahomey, an area 120 km. long and 60 km. wide, say 7 200 sq. km., from which 2 500 sq. km. of marshes, lakes, lagoons, savannah, brush, etc. should be deducted. This region represents an area of 4 700 sq. km. of stands of average or high density.

2) The dense stands in the circles of Abomey, Zagnanado, and Holli-Ketou, representing some 1 600 sq. km.

In round figures, the total area of the palm groves of industrial importance amounts to some 6 000 sq. km.

Density per hectare. — Excluding old and unproductive trees, it may be said that, if the average total density of Dahomey is 100 trees per hectare, the industrial density, including those *Elaeis* that produce normally, is not more than 50 trees per acre. This represents a safe minimum which is accepted so as to remain within the limits of an accurate evaluation.

Total industrial population of trees. — The total number of palms, whose crop could be gathered when the wild groves are generally organised, taking into account the above considerations and reckoning

on a practical density of 5 000 per sq. km., amounts to 6 000 × 6 000, or 30 million trees.

Average yield of an oil palm. — In a normal grove that is looked after to a certain extent, it can be said that each palm yields about 70 kg. of clusters a year. With the De-Yaya variety, which is practically the sole variety in the groves, the fruits constitute 53 % of the cluster, but, in certain fleshy forms yield as much as 66 %. Allowing for fruits that are malformed owing to compression in the centre of the cluster, there is an average proportion of 50 % of fruit in comparison with a total weight of fresh clusters. Therefore, an *Elaeis* gives an annual yield of 35 kg. of *utilisable* fruits.

Composition of the fruit. — According to SAVARIAU, the composition of the fresh fruit is as follows:

Variety	Pericarp	Shell	Kernel
Dé	42.5 %	45.0 %	12.5 %
Kissédé	49.1	52.6	18.3
Degbakoun	66.5	17.2	16.3
Votchi	79.5	7.9	12.6
Fadé	35.9	44.3	19.8

The palm-oil content of the pericarp, compared with the *fresh* fruit, is given below:

Variety	First analysis	2nd. analysis
De	24.9 %	21.2 %
Kissédé	29.1	26.5
Degbakoun	27.5	32.7
Votchi	47.1	43.7

Theoretical yield from 100 *kg of fruit.* — The theoretical yield from 100 kg. of the different varieties of *Elaeis* in Dahomey should be:

Variety	Kg. of oil	Kg. of kernels
Dé	21.2 to 24.9	12.5
Kissédé	26.5 to 29.5	18.3
Degbakoun	37.7 to 27.5	16.3
Votchi	43.7 to 47.1	12.0

Is should be remembered that the stand is practically entirely composed of the De Yaya variety. The Degbakoun, Kissédé, Votchi and Fadé varieties are very rare and scattered, while their total number is certainly less than one-tenth of the total *Elaeis* population.

However, the natives prefer to use the fruits of the Votchi and Degbakoun varieties for the preparation of the oil they use as food.

The industrial oil, then is, practically entirely furnished by the De-Yaya variety, which gives an average yield of 22 kg. of oil per quintal of fresh fruit.

The same does not hold good for the kernels of the different varieties, since only the pericarp of the Votchi and Degbakoun varieties is reserved for the production of edible oil, but it may be reckoned, taking into account the constitution of the palm groves, that each quintal of fresh fruit yields 22 kg. of kernels.

Products obtained using native methods. — The native method consists in pressing the fruit in the presence of water with the hands or feet. The average yield of oil from the fresh fruit is 10 %, whereas the theoretical oil-content of the pericarp of De-Yaya is 22 % of the fresh fruit (see above).

Theoretical yield of Dahomey in palm kernels. — As it has been calculated that there are 30 million palms that could be exploited in the future, and as each yields 35 kg. of utilisable fruit each year, and allowing for variations, parasitic attack, etc., an industrial yield of only 22 kg. per tree can be counted on, or an annual production of 600 million kg. of palm kernels.

As it has been assumed that 100 kg. of fresh fruit yields 22 kg. of oil and 13 kg. of kernels, the total theretical capacity of Dahomey would be 132 000 metric tons of oils and 78 000 m. tons of kernels. But as the kernels are less susceptible to factors that decrease the yield of pulp, the production of kernels may be said to be over 78 000 m. tons or, according to the author, 100 000 tons.

Possible theoretical exports. — The quantities of 132 000 m. tons of palm oil and 100 000 m. tons of kernels would not be available in their entirety for exports. Assuming that sufficient factories were established to extract all the fruit and that, in consequence, the oil is extracted with the minimum loss there would still be a wastage of some 3 %, representing the fat that would inevitable remain in the cakes, or some 18 000 tons. The local consumption for food, lighting and soap making absorbs about 15 000 tons a year. A deduction of 18 000 + 15 000 m. tons = 33 000 tons should therefore be made. As the kernels are not much utilised locally for the preparation of palm oil, the deduction to be made in this respect is insignificant.

Theoretically, therefore, the total quantity available for export would be 100 000 m. tons of oil and 100 000 tons of kernels.

Actual exportation. — On an average, the annual export is 12 000 m. tons of palm oil and 30 000 m. tons of palm kernels. The native consumption is about 15 000 m. tons of palm oil, so that the annual production is some 27 000 m. tons of palm oil.

The native by no means gathers the harvest from all the palms in a state of production, and he is usually content with exploiting the most

easily accessible groves and the most productive trees, as long as he makes his usual profit.

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It will be seen that the utilisation of the stands of Dahomey is very small compared with the total theoretical capacity, the reason for this being: 1) the faulty harvesting of the groves; 2) the considerable losses of oil due to the exclusive use of the native method of extraction.

This state of affairs can be improved by cultivating the palm groves in a rational manner and, by founding extraction works, gradually approaching the theoretical capacity as soon as the agricultural population becomes sufficiently dense so as to be obliged to make use of all the available resources. This will take a long time and will call for slow progress. For the moment, there is no possible chance of the exports even overtaking or surpassing one half of the values ascertained previously.

The author discusses the methods of improving the cultivation of the palm and the organisation of the oil works.

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Cultivation of the oil palm, its disadvantages. — There as two cases:

1) In the neighbourhood of Porto Novo, in the regions of Abomey and Zagnanado and in the immediate vicinity of most of the important centres, the palm groves are entirely cleared and the cultivation of food plants in the groves has led to the total disappearance of the high brush and is progressively destroying the low brush.

As the palms are freed, they benefit from the maximum of sunlight and the cultivation off the soil around the stools. They are visited each year, the dry leaves are cut of and the clusters are disengaged during their growth, so that the palms can give a maximum yield as they are little affected by the exhaustion of the soil due to crops that only grow in the top layer.

However, there is a serious defect in certain stands, as the groves contain many aged palms whose production keeps on decreasing until the tree dies. The young plants which usually spring up naturally, are often too few in number to keep the density constant, and, in addition, they often grow in such a way that gaps are produced when the old plants die

But, it may be said that palm growing in these regions is nearly perfect; all that is required is to maintain the stand and pay attention to manuring the soil in order to get the maximum yield from both food crops and palms.

2) In other cases, the oil palm is mixed with brush of varying thickness and height according to the speed with which the crops follow in the rotation. It then receives no special attention. At present, about half of all the palm groves receives either no cultural attention or is cultivated in a very rudimentary way.

Improvements in cultivation; increased stands. — The stands should be extended by increasing the density of open groups and by planting new groves on soil cleared for cultivation. More labour is necessary and factor-

ies should be provided that would liberate more labour. The cultivation itself should be improved and greater attention paid to it.

Rapid crop rotation. — The crop rotation is too slow, plots cultivated for 2 or 3 consecutive years on a forest clearing being abandoned to the brush for as much as 10 or 15 years. With a more rapid rotation, the native would plant his annual crops on the palm lands and would gradually exterminate the brush (as at Porto Novo and Abomey). One of the best methods is to encourage the spread of cacao and coffee growing in sufficiently open palm groves (1).

Selection and multiplication of the best varieties. — Nothing has yet been done in this connection. Certain forms of the De-Yaya variety should be studied and the Agricultural Department should install nurseries.

Harvest of the oil palm. — To do this, the native has to climb the palm on several occasions.

It is a long, difficult and often dangerous operation that may have to be repeated for plants with many fruits, if the clusters are gathered when just ripe. The older and, consequently, the taller the palm, the greater the labour of gathering the crop, although the production is smaller than that of trees of medium age and a shorter stipe.

The number of climbers has a tendency to decrease and it is probable that the extension of the groves will be hindered or even arrested by the lack of men to gather the harvest if the present method is continued.

Elaeis gives its maximum yield at 15 to 35 years, i. e., during a period when its stipe is relatively short and when the crop can be gathered with the aid of a ladder. After that age, the yield slowly decreases and becomes very small with very high trees. The constitution of the grove, then, should be radically changed. The young trees should be harvested with the aid of a ladder — an easy process. The climbers would only harvest those high palms that are still very productive. The very high and old palm trees should be destroyed as soon as the ascent becomes too difficult.

Groves organised in this way would contain two-thirds of *Elaeis* of the first category and one-third of the second, and the cultivator should try to keep this proportion constant.

This method, while rendering harvesting more easy, more rapid, and less troublesome — a man with a light ladder can visit many more trees than a climber in the same time — would above all result in regularising the crop and would allow the bunches to be gathered when fully ripe. The accomplishment of this is obviously far off, but it can really only be applied wholly, to new plantations, and progressively to certain natural groves when these have been entirely cleared of brush and judiciously completed.

B) Industrialisation of the crop.

The most urgent and successful remedy is to industrialise the crop, which would be shown by a rapid growth in the increase of the present production.

(1) This touches on the interesting question of intercalary crops in other types of plantation, particularly rubber (see *R.*, Feb. 1919, No. 205, VI) and the coconut palm (*R.* Febr. 1919, No. 201. II). (*Ed.*)

A first attempt at the installation of a factory has been made at Cotonou, in Dahomey. It failed, although use was made of a new process in which the whole fruit or pulp is pressed in the dry state, and which, with suitable presses and proper management, should give the best yield as it is much superior to the wet extraction process which requires more plant, longer and more frequent extractions and leads to increased loss.

The serious defect of the Cotonou factory was its distance from the producing centres, which made supplies uncertain and difficult to obtain on account of its remoteness and the difficulties of buying from a population that was not prepared. The experience obtained will be valuable in view of other attempts, although the " Fournier " type of press used was not satisfactory as regards the method of closing. All that is required is to benefit from the lesson of this first attempt, which did not survive its director, unfortunately, as he had shown that the process used was of interest and that its future was purely a question of machinery ; its adoption in most of the factories in the adjacent colonies is the best proof if its value and it will probably be used in all the works established in the future.

The type of factory required. — At present, it is not easy to advocate the adoption of any particular type of factory, using observations made on the actual plants, as they are for the most part, of an experimental nature. However, some idea may be obtained by comparing data furnished by different factories, provided that various factors not of an industrial nature, such as the density of the groves, the kind of ownership of the groves, abundance of labour, facilities of water supply, the commercial customs of the native population, be taken into account.

As the author paid an official visit to various factories on the Ivory Coast and in Togoland, he was able to collect a series of technical and commercial documents to serve as a basis for the determination of the type of factory to adopt. The oil works at Abidjan, Ana, and Imperia (Ivory Coast) and Batonou and Agu (Togo) are discussed.

Machinery. — As regards the machinery, the method and plant that should be adopted are given below :

1) Sterilisation and cooking of the fruit in double-bottomed, steamheated autoclaves, the true steriliser only being used when supplies are abundant.

2) Pressing the fruit in an hydraulic press, using a machine like that at Batonou which, for a factory treating 8 to 12 tons, had 4 presses and 3 boilers, the latter having an area 4 times that of the press cylinder.

3) Collection of the oil ; the first quality oil is purified by a heat treatment at 90-100° C., and by passing through a filter press.

4) Cooling in a tank and preparation for transport.

5) Depulping the pressed fruit (the " Fournier " depulper ; the " Trevor " depericarper, etc., are good but have serious defects ; there are also other types and suitable modifications will probably be made) ; the pulp is taken to the boilers and presses, and gives an oil of second quality and higher acidity, which is purified by heat, filtered, cooled and put in barrels without being mixed with the oil of prime quality.

6) The nuts pass from the depulper and can be sent at once to dry, either in the sun or in a hot-air drier, before passing to the crusher and the bath for separating the kernels.

Cost price, daily income and expenditure of a plant treating on an average 10 *tons of fruits a day.* — At pre-war prices, a plant like that described would cost, according to the author, 160 000 fr., or 16 000 fr. per ton (according to M. TREVOR, this price would be 200 000 fr., or 20 000 fr. per ton).

The price of the ton per day decreases rapidly with increasing size of the works and it is not more than about 8600 fr. for an oil factory treating 300 m. tons of fruit a day. In spite of this large difference, the large capacity plant is not economically possible at present in Dahomey, as it could not get sufficient supplies; it may be possible in the future, but now it is out of the question.

For a plant treating 10 tons a day, the working expenses for the whole year, calculated on a basis of 240 working days, amount to 485.20 fr. per working day, with depreciation calculated at 20 %. The daily receipts of such a factory, assuming that the fruit yields 18 and the kernels 13 % of oil, would be 675 fr. The daily profit, then, would be 190 fr., or 45 600 fr. in a year of 240 days.

The oils would not depend on local commerce, but the manufacturer would be his own exporter and thus add to his local profit the commercial profit obtained by selling his produce on the European market, which would realise a much higher profit than that shown above.

Conclusions. — The previous considerations all lead to the conclusion that the small-capacity oil factory can exist and make, in spite of risks that could not be foreseen in this study, a good profit for the owner. This is not so with large works, as the moment for them has not yet been reached.

The factory will not be able to work normally during the first year, as there will be the inevitable tentatives until everything works smoothly. It will suffer from irregular supplies of fruit, for the native, suspicious by nature, will hesitate before he decides to bring his products in as they are gathered; at least a year is necessary to educate him and every effort should be made to obtain the custom of the most powerful chiefs. But it is rare that an industry in its early stages does not have to overcome the difficulty of obtaining supplies of raw materials and the oil works established in a new country cannot escape this law.

The author regrets the lack of initiative shown by the big commercial installations in Dahomey, which confine themselves to trading. They ought to install oil factories as well as plantations, of coconuts, coffee, cacao, tapioca works, etc.

Now is the time for those who live mainly on the exportation of palm products to repair this error and increase their commercial capacity by establishing oil works which would double their profits. They have no need to fear competition from large companies that run greater risks for the sake of quick returns and which might establish themselves in the fertile soil of Dahomey, as there is room for everyone.

II. — The world war has led to the creation or considerable development of various industries, some of which will become permanent. Amongst these, the oil and fat industry in England, which was little developed before 1914, has greatly advanced.

When the importance of the question became evident, i. e., in the middle of 1915, the British Government appointed a committee composed of large African traders and important colonial officials to examine the

present situation and the future of the West African trade in edible and oil-producing nuts and seeds, and to report what measures should be taken to develop in Great Britain the industries that utilise these products.

The Report, which was presented to Parliament in June, 1916 (1) has been translated by the Colonial Institute at Marseilles and the translators (2) have examined the evidence and grouped the conclusions in a logical order, while eliminating any repetition. An introduction is given showing the chief conclusions reached in the report and the way the future of the production, trade and industry of the products of the oil palm should be considered.

In the second part of their work, the authors have collected all the information available regarding machines invented for depulping fruit, extracting palm oil and breaking the kernels. An appendix gives all the available information as to experiments carried on in the French colonies or in the former German colonies on the mechanical treatment of the fruit of the oil palm. In conclusion, statistics are appended showing the world's production and consumption of fats.

On account of the length of the work (400 pages) and the amount of detail it contains, it is only possible here to give an analytical summary of the contents.

INTRODUCTION (pp. IX-XXIV). — The pre-war palm-kernel industry in England and Germany.

II. — The present state of the fat industry in England and Germany.

III. — Measures for improving and developing the exploitation of the oil palm (This question is treated in detail in the first part of this abstract).

PART I (pp. 1-255). — *Critical Summary of the Report of the British Committee on Oil producing Seeds and Nuts.*

Chapter I. — Situation of the fat industry in England.

Chap. II. — Trade in palm kernels.

Chap. III. — Commercial advantages possessed by the Germans.

Chap. IV. — Maritime transport of palm kernels and oils.

Chap. V. — Advantages and disadvantages of different ports.

Chap. VI. — Establishment of a tax to assist the English palm-kernel industry.

PART II (many figures). — *Machinery for preparing palm kernels and oil.*

Hand machines for preparing palm oil : the Givira, Phillips and improved Philips machines.

Power machinery for preparing palm oil : — Hawkins machine (for removing the fruit from the bunch) — Forumier plant, Agupflanzung plant, Hawkins process (for pressing the whole fruit without breaking the nut) — Buchanan and Tyrell depulpers, the C. H. Dyer and G. Innes-Ward processes, Graig plant, Olier plant, Trevor depulper, process of the Maka plantation in the Cameroons (for removing the pulp from the nuts before pressing).

Shelling the palm nuts : — centrifugal shellers, other shellers, separation of the kernel and the broken shells.

APPENDICES. — I. Industrial and native methods for preparing palm oil on the Ivory Coast and in Gabon, by M. A. BORIS (Agricultural Inspector of the General Government of French West Africa).

(1) *Report of the Committee on Edible and Oil-producing Nuts and Seeds.* June, 1916 [Cmd 82 47]. London, H. M. Stationery Office.

(2) *Bulletin des Matières Grasses*, No. 1, 1919. (*Ed.*)

II. The mechanical treatment of oil-palm fruits in Togoland and the Cameroons.

1) Extract from the Report of the Fats Commission of the German Committee for Colonial Economics.

2) Report of the German Dr. FICKENDEY.

3) Report of M. E. ANNET (Officer in the Army of Occupation in the Cameroon) on the Maka factory.

II. Palm-kernel cake, note by M. A. STIELTJES.

IV. World statistics for fats.

Movement of fats. — Imports of fats into France (special trade). — Exports of animal and vegetable fats from the French Colonies in 1913. — Exports of oil and oilseeds from British West Africa in 1913. — Average value of palm kernels. — Value of palm oil per ton. — Exports of palm kernels in 1913. — Exports of palm oil in 1913. — Exports of palm kernels and palm oils. — Exports and imports of groundnuts in 1913. — Exports, in 1913, of rape, copra, cotton, linseed, olive oil, castor oil, sesame.

The following figures relating to palm oil and palm kernels are taken from the large mass of world statistics : —

Countries	Exportation (in tons) of					
	Palm kernels			Palm oils		
	1896	1913	1917	1896	1913	1917
Gold Coast	13 242	9 754	4 768	9 568	3 500	816
Sierra Leone	21 400	49 201	58 020	1 305	2 500	2 280
Nigeria	85 553	174 718	185 998	49 995	83 090	74 619
Gambia	150	545	532	—	—	—
Guinea	2 659	5 170	7 070	200	164	265
Ivory Coast	1 247	6 950	—	4 812	6 014	—
Dahomey	25 151	26 370	17 015	5 524	7 971	11 865
Senegal	373	1 760	3 043	—	—	—
Gabon	378	575	—	165	118	—
Togoland	—	10 000	8 326	—	5 000	1 501
Cameroon	—	19 556	—	—	4 612	—
Belgian Congo	—	7 205	35 000	—	1 974	5 394
Angola	—	3 760	—	—	920	—
Portuguese Guinea	—	6 621	—	—	—	—

424 – **Exploitation of the Oil Palm on the Ivory Coast and in Indo-China** (1). — *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 12, p. 381. Saigon, December 1919.

M. TEISSONNIER, Head of the Agricultural Service of the Ivory Coast, published, in the *Annales de l'Institut Colonial de Bordeaux* in March, 1919, a study on *Elaeis guineensis* and as this was of interest regarding the cultivation of this palm in Indo-China, M. VERNET has summarised the chief points of importance for the latter colony.

The oil palm is very sensitive to cultivation ; M. HALLET, obtained 2.3 kg. of fruits per tree (6 years old). Owing to this, a capital of 8 million francs has been devoted to the exploitation of this plant, which is a crop new to Sumatra.

(1) See *R.*, Feb. 1919, No. 200.

The exports from Guinea, the Ivory Coast and Dahomey have ranged from 20 640 t. in 1910 to 18 399 tons in 1917 for palm oil and from 44 785 44 785 t. in 1910 to 30 216 tons in 1917 for palm kernels (1).

In a natural grove, there are palms in all stages of development. Old *Elaeis* hardly produces at all, and when they are about 40 ft. high, the harvest is lengthy and difficult. If a climber can gather 15-20 bunches a day on light trees, he can easily gather 8 or 10 times more when the height does not exceed 40 feet.

The first aim in the management of old palm groves should be to eliminate the old trees and to replace them gradually by young trees just becoming or about to become productive.

The author is of the opinion that these considerations can be applied directly to the Indo-Chinese palm groves. It would be easy to arrange to replace the *Elaeis* regularly in the plantation as they become too old by establishing graded series under cultivation, which would in addition ensure the regularity of the production.

It would be useful to determine the economic limit of the productivity of *Elaeis* in Indo-China and the author points out that, at Suoi-giao, trees nearly 20 years old and on which the bunches are at a height of about 30 ft., have a decreasing yield, while it is difficult to gather their fruit. But the palms in question are in the middle of a *Hevea* plantation and, possibly, under other conditions they would have kept up their yield for a longer time.

The author suggests that a method that would give good results as regards this subject as well as selection, would be to start the first replacement stand between the lines at an age of 8 to 10 years, using plants obtained from parents giving the best yields.

In order to avoid cross-fertilisation, it would be possible, as indicated by M. TEISSONNIER, to prepare seed-bearers at the right moment and fertilise them artificially. It is recommended that the plants obtained from different producers should be planted separately so as to begin pure line selection as soon as possible.

425 - **Contribution to the Study of the "Guayacan" *Caesalpina melanocarpa*.** — Perez B., in the *Universidad de Tucumdn, Informes del Departamento de Investigaciones industriales*, No. 6, pp. 17-24 + 2 Figs. Buenos Ayres, 1918.

Histological study of the stem and leaves ; tannin content of the fruit ; preparation of ink ; utilisation of the fruits for dyeing and tanning.

Out of 80.49 parts of the total residue left on evaporating the aqueous extract of the powdered fruit of *Caesalpinia melanocarpa*, 73.83 are soluble and 6.66 insoluble ; the soluble residue consists of 27.83 parts of tannin and 46 parts of non-tannin.

Ink can be made according to the following formula : — powdered guayacan fruits 12.5 gm. + distilled water 200 gm. + gum arabic 6.25 gm. + iron sulphate 6.25 gm + officinal solution of iron perchloride 5 gm

(1) See No. 423 of this *Review*. (*Ed.*)

By using lactic acid as a mordant, the powdered guayacan fruits plus one-twelfth their weight of iron sulphate dye wool grey.

The powder of this fruit can apparently be used in tanning.

RUBBER GUM AND RESIN PLANTS

426 – **Effect of Removing the Pulp of Camphor Seeds on their Germination and on the Development of the Plant.** — Russell, G. A., in the *Journal of Agricultural Research*, Vol. XVII, No. 5, pp. 223-228 + 5 Figs. + 2 Pl. Washington, D. C.

A contribution from the Bureau of Plant Industry of the U. S. Department of Agriculture to the experimental study of the cause of the low germinating power of camphor seeds. The results of the germination tests, given in a series of tables and diagrams are discussed by the author.

It was found that by removing the pulp, of the seeds, they germinated 2 weeks earlier on an average, the percentage of germination being more than 5 times that of untreated seeds. The plants produced by seeds whose pulp had been removed give, when transplanted, taller, larger and more vigorous trees than seeds whose pulp had not been removed. The author states that in practice the removal of the pulp increased the germinating power some 200 times, which, together with the more vigorous growth of the seedling, largely compensates for the cost of the operation.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

427 – **Analyses of Annam Teas** (1). — Bussy P., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year I, No. 10, pp. 308-309. Saigon, October, 1919.

The sample analysed came from a provision of 337 600 kg. supplied to the " Service de Ravitaillement " by M. Guenin, a trader at Tourane (Annam).

The method used for estimating the caffein (thein) is described in the Formulary of Dr. Bissemoret, p. 280 (published by Boulange-Dosse and Co., 4-6, rue Aubriot, Paris).

Substances estimated	Extra tea	Superior tea	Superfine tea	Fine tea	Recovery	Dust
Water	8.22 %	8.95 %	8.33 %	8.13 %	9.03 %	4.45 %
Acqueous extract . .	16.74	19.92	19.00	16.60	14.24	17.90
Ash	7.50	7.37	6.85	6.43	7.00	7.84
Caffein % of tea dried at 100° . .	3.09	3.75	3.45	3.55	2.72	3.56

428 – **On *Tagetes anisata* n. sp. a Source of Essential Oil.** — Zelada, F., in the *Universidad de Tucumán, Informes del Departamento de Investigaciones industriales*, No. 8, pp. 5 + 7 Figs. Buenos Ayres, 1918.

Botanical description and histological study of the Composite *Tagetes anisata* Lillo n. sp. (very close to, but distinguished by several cha-

(1) For Indo-Chinese tea, see *R.* Nov. 1918, No. 1243 ; *R.* Apr. 1919, No. 467 and *R.* March 1919, No. 601. (*Ed.*)

racters from *T. pseudomicrantha* Lillo and *T. micrantha* Cav.), very common in the Argentine in damp pastures in the zone between an altitude of 3250 and 9000 ft. By distilling the green plants in a current of steam, 0.7-0.8 % of a green oil was obtained, which was similar to, but not identical with that of common aniseed and which had the following characteristics :

Density at 15° C.	0.9862	Alcohol in C_{16} H_{18} O	0.852 %
Boiling point C.	214-218°	Ethers in C_{16} H_{17} $COCH_3$	1.082 %
Solidifying point	—6°	Acetyl index	23.4
Polarimetric deviation	—1°,10'	Total alcohols in C_{16} H_{18} O	4.311 %
Refractive index	1.5432	Free alcohols in C_{16} H_{18} O	3.229 %
Solubility in alcohol at 90°	1 : 5	Iodine index	158.5
Saponification index	3.1		

429 – **Tobacco Growing in Algeria.** — MANCHERON, P. in the *Revue Agricole de l'Afrique du Nord*, Year XVIII, No. 30, pp. 136-140 + 3 figs. Algiers, February, 27, 1920.

Tobacco is of considerable importance among the crops of the French colonies in North Africa. It is the crop that has so far benefited most from rich soils of all the valleys near to the coast that have not yet been planted with vines. It may thus be justly considered as the chief industrial plant of the country. Before the war, Algeria produced 60 000 quintals of dried tobacco leaves, valued at about 4 million francs.

Tobacco growing is very expensive, but it yields greater profits than cereals and so its cultivation is continued. But, in certain places, there seems to be a change of opinion and the possibility is being contemplated of replacing tobacco by the sugar-beet (1).

Tobacco soils suit the sugar-beet perfectly, as both plants have the same requirements. But while tobacco removes all the food material it has extracted from the soil, the sugar-beet restores the greater part of the inorganic salts it contains, which is very important, considering the cost of fertilisers.

The author thinks that tobacco growing should not be completely abandoned in Algeria but, when there are sugar factories in the country, it will pay to reduce tobacco growing as far as possible, confining it to compact clay soils with damp subsoils, such as those in the Seybouse valley, near Bone.

VINE GROWING

430 – **Production of Vines Grafted on American Plants in North Africa.** — VINET, E., in the *Revue agricole de l'Afrique du Nord*, Year XVIII, No. 24, pp. 35-38. Algiers, January 9, 1920.

The author (Professor of Viticulture at the Agricultural School at Maison-Carrée, Algiers) gives advice on the choice of stock suitable for vine growers in North Africa who have to replace their ungrafted vines by vines grafted on American plants.

The following are best suited for the type of soil described : —

1) Alluvial soils, rich, open, fertile, with little lime, retaining moisture in summer : — Riparia Gloire de Montpellier, 3309, 3306.

(1) See *R.*, Feb. 1920, No. 208. (*Ed.*)

2) Alluvial soils, rich, with medium lime (up to 50 %), compact and dry but not excessively so : — 420 A, 161-49.

3) Compact, very dry soils : — 93,5, 18 808 and 18 815.

4) Compact, damp soils : — 93-5, 216[3] (under trial).

5) Soils containing over 50 % of calcium carbonate : — 41 B and Berlandieri.

431 – **The Role of the Callus in Grafted Plants.** — See No. 403 of this *Review*.

FORESTRY

432 – **Forestry in Libia.** — I. Fossa P., Primo esperimento dell'A.mministrazione italiana in Tripolitania per consolidare e rimboschire dune e terreni interdunidici, *Ministero delle Colonie, Ufficio Economico, Bollettino di Informazioni*, Year IV, Nos. 7, 8, and 9, pp. 287-302 + 1 Fig. + 1 Map. Rome, 1916. — II. Secondo rapporto del R. Ufficio Agrario di Tripoli sugli esperimenti di consolidamento e rimboschimento di dune mobili, *Ibid.*, Nos. 10, 11 and 12, pp. 497-521 + 19 Figs. 1917. — III. Terzo rapporto sugli esperimenti di consolidamento e rimboschimento di duno mobili (Relazione del R. Ufficio Agrario di Tripoli), *Ibid.*, Year VI, N. 1, pp. 36-45 + 4 Figs. 1919. — IV. Quarto rapporto sui risultati degli esperimenti di consolidamento delle dune mobili in Tripolitania, (Campagna 1917-18), *Ibid.*, pp. 47-56 + 2 Figs. — V. Leone, J., Il valore agricolo della Tripolitania, *Ibid.*, pp. 20-25 + 9 Figs. — VI. Mangini, A., Appunti sulla vegetazione della Cirenaica e sulla utilizzazione agraria, in l'*Agricoltura Coloniale*, Year XIII, p. 515-546 + 7 Figs. + 1 Map. Florence, 1919.

I, II, III, IV. — The Italian administration of Tripolitania undertook, in February, 1916, afforestation experiments on soils invaded by dunes. The first researches showed that the soil of the dunes and steppes is practically the same as that of the oasis of Tripoli, the only difference being the difficulty met with in watering ; in addition, the rainy season there is limited to the period between October and February, with 300 to 400 mm. of water.

In order to grow forest trees successfully in this region, it is necessary :

1) To choose xerophilous or at least drought resistant plants, which should be obtained from a local nursery.

2) To use long and robust plants or cuttings, so that, when planting them, they can be pushed down to the lower layers where there is some moisture, even in summer.

3) To plant and sow either a few days before or during the rains.

4) Before growing them on a large scale, carry out tests in different months and with different methods.

The experiments were continued up till autumn, 1918, and lessons and rules can already be deduced from them, so that it is possible to establish a programme for the improvement of land invaded by sand.

The technical method for consolidating moving dunes, as far as it can be determined from experiments lasting 3 years, is suitable for continental or interior dunes only as these differ essentially from the maritime dunes in the fact that their movement in any fixed direction is much slower or does not occur ; again, new deposits of sand are either not formed or formed very slowly. As the conditions are more simple, the problem is consequently more easy to solve. In fact, in experiments carried out near Tripoli, it was not found necessary to provide works for pro-

tection against the dunes or even to fix the sandy surface with the help of herbaceous plants, before proceeding to afforestation, which can be begun the first year.

As regards the experiments for fixing and afforesting the moving dunes on the coast, the projects for the territories of Zuara and Lebda (*Leptis Magna*) near Homs are now under consideration. The work can only be started in 1919-1920 and the procedure will be based on the classic methods employed in Europe, particularly in Gascony. The practical application of these methods will show the modifications necessary in the case of the coastal dunes of Libia and after this the full plan for work on the coastal zone troubled with sand will be drawn up.

Receding steppe and hollows between dunes. — In many cases, it is sufficient to forbid any thoroughfare, pasturage and cropping so as to allow the natural vegetation to spring up and increase, and thus consolidate the soil. Afterwards, pasturage in moderation may be allowed. If it is desired to profit from these soils after their fixation by the natural vegetation, trees such as the *Tamarix*, *Parkinsonia*, mulberry and Aleppo pine should be planted.

True dunes. — Although low, isolated dunes can be planted all over their surface in one operation, with large dunes or those that form part of a large sandy area, the process must be gradual. After ascertaining the superficial area that requires consolidating, barriers should be put up to prevent men and animals passing across, but the barriers must not offer any obstacle to the passage of sand or wind. If, however, the surface in question is in contact on one of its sides with other dunes that are not yet consolidated, it will often be necessary to erect hedges or fences, so as to avoid fresh deposits of sand for a certain time ; then plantation can be begun passing from the periphery to the centre and from bottom to top. In the case of dunes with very steep slopes, it is sufficient to plant from the base to about half-way up, then up to the top ; if not, the work of consolidation should be divided into three periods.

While planting (using plants or cuttings, according to the species), hedges or defence rings should be formed with herbaceous or bushy steppe plants (especially with *Malcomia aegyptiaca*), so as to divide the planted area like a chess board, the size of whose squares should be greater or smaller as the surface is more or less sloping. These hedges are made by placing the plants in a small furrow in the sand in such a way that one-third is left uncovered, and pressing down the surrounding sand very formly.

The distance between the plants is very variable and is fixed, by the growth of the particular species and the slope of the surface. In any case, it is better to plant at greater distances than is usual in ordinary agricultural plantations, so that the roots can have full play in the largest mass of soil compatible with their consolidatory function. The depth of planting should always be from 75 to 100 cm.

During its growth the plantation should be watched and carefully examined, especially after the advent of strong winds, so as to repair any eventual damage caused by the movement of the sand ; where the roots

of the plants are uncovered they will be covered up again, and where the plants are buried they will be uncovered. In the second year the damaged portions of the hedges will be repaired and any cuttings that have not taken root will be replaced ; at the same time, new sections will be planted until the whole area is covered.

Certain of the species planted should be pruned in the second year (*Tamarix, Parkinsonia*, etc.), others, such as robinia or reeds, etc., being pruned later on, and each tree should be pruned according to its own particular method. The best type of pruning for the species mentioned is nearly always cluster pruning, except in the case of trees to which it is unsuited.

Plants certain to be successful : — *Tamarix articulata, Robinia Pseudo-acacia, Arundo Donax, Parkinsonia aculeata, Pinus halepensis.*

Plants whose success is still uncertain or depending on a cultural technique not yet fully proved : — *Populus italica, Acacia longifolia* and spp., *Eucalyptus* sp., *Casuarina* sp., *Ricinus communis, Retama Raetam-Tamarix gallica, Grenvillea robusta, Cryptostegia* sp., *Brachychiton diversifolium, Sophora japonica, Morus nigra, Melia Azederach, Cercis Siliqua, strum, Pistacia vera, Pinus canariensis, Pinus Pinea, Phytolacca decandra Mesembryanthemum acinaciforme.*

Known to be scarcely suitable : *Opuntia Ficus-indica, Olea* sp., *Ailanthus glandulosa, Agave* sp., *Nerium Oleander, Punica Granatum, Populus alba, Eucalyptus Globulus*, etc.

V. — Amongst the plants tested on a large scale and with a considerable number of species, without excluding those already existing in Tripolitania, but which, up to the present, have been cultivated in irrigated soil, the following trees have been found to be particularly suitable for the purpose in question : — *Eucalyptus* spp., *Acacia latifolia* and *A. longifolia, Tamarix*, pines, *Casuarina* spp., *Parkinsonia aculeata*, the cypresses, and other species about which a definite opinion cannot yet be given. The following trees are specially important : — *Eucalyptus* (*rostrata, resinifera, saligna*) and *Tamarix articulata*, which are specially adapted for these conditions of growth. In two years, wind-breaks planted with these trees have formed real walls protecting the irrigated orchard of the Agricultural Institute at Sidi-Mesri ; growing on the open steppe, they are much admired by visitors.

The success of both dry and irrigated orchards depends on an essential condition too often neglected by the natives and the Italian colonists, namely, wind defences. Owing to their regularity and velocity, the winds are more to be feared than the usual drought, for they often strip the young plants of their leaves in winter, destroy, the tender buds and shoots, and, when they are laden with sand, tear off the bark from the young plants at some distance from the soil. Therefore, the chief factor in obtaining a successful orchard is to be armed against the destructive action of the wind.

This is why, after choosing the site for the orchard, the first trees to be planted are those that will serve as a wind-break later on ; these trees,

while still young can be protected by little walls of beaten earth, so that they can properly develop their root-system and provide, 2 or 3 years, later, a splendid wind-break for the young fruit trees planted in the meantime. Such wind-breaks should not only surround the orchard but divide it into sections of a size corresponding with the species of fruit tree grown.

Besides *Eucalyptus* spp. and *Tamarix articulata* the *Casuarina* spp. and cypresses can be used as wind-breaks, but they are most suited to irrigated orchards where they can benefit from the irrigation.

VI. — In Cyrenaica, the conditions from the standpoint of forestry and ecology, can be summarised as follows : — All the vegetation of the Bengasi plain is of the xerophilous type ; in the north, the soil is thickly covered with high underwood and a few trees, with good pastures and a few prairies ; the flora is of the Mediterranean type. As one goes south, the underwood diminishes and finally disappears and is replaced by the steppe of varied nature ; the species belonging to the desert flora become more numerous, the pastures become smaller and poorer, and the vegetative cycle of the annual florets is shortened. The botanical appearance, so different between the northern and southern regions of the plain of Bengasi, is not only due to the quantity and distribution of the rainfall, but is influenced considerably by the southern winds ; their depressing action on plants, which is very intense in the pre-desert area, becomes less serious as they approach the north.

The vegetation of the northern slope of the plateau of Cyrenaica, however, belongs to the *Lauretum* forest zone, according to the classification of Mayr. All the species characteristic of the *Lauretum* zone, or a greater part at any rate, are represented in the flora of that region of Cyrenaica that faces the Mediterranean. A considerable part is covered, as regards the commonest types, with low and high coppices, thickets and woods, isolated trees, and, towards the south side, a large part of the first and second terraces appears to be more or less thickly, though irregularly, wooded. Above this region, through a territory of varied, occasionally irregular configuration, one arrives at the dividing line of the watershed, followed by the gradual descent of the southern slope. The area lying between the southern limit of the region of thickets and woods and the dividing line of the watershed, which is very irregular, now narrower, now wider and extending towards both north and south, is generally bare of trees or shrubs. It becomes more important to the east of the plateau of Cyrenaica and to the west of that behind Merg. Towards the west, the landscape, the appearance of which is poorer and poorer, runs into the plain of Bengasi at the point where the thickets end and where the immensity of the steppe spreads away far out of sight. Towards the east, the bush vegetation, already impoverished around Derna, retains some slight importance in the direction of Marmarica.

The same associations, i. e., thickets, but more often woods, appear on the southern slope, where they cover immense areas, especially along the " ouidian ", while, further to the south, the steppe dominates.

433 – **Red Gums (*Eucalyptus* sp.) and the Utilisation of their Wood in Cabinet-Making.** — TRABUT, in the *Comptes rendus ds Séances des l'Academis d'Agriculture de France*, Vol. VI, No. 1, pp. 37-39. Paris, January 7, 1920.

Since the eucalyptus was introduced into Europe and North Africa, the merits of this Australian wood have been as much contested as praised, the reason for the difference of opinion being an absolute lack of method in the tests. Practically all the species introduced (about 100) have been confused with *E. globulus*, which is the best known one, and more absurd prejudices have been entertained than sound appreciations of the facts. It is now time to investigate the many uses of the wood of these trees, which grow admirably in the Mediterranean region and which grow 5 times more quickly than the other indigenous or acclimatised trees.

The author has studied the acclimatised species of eucalyptus since 1875 and he is certain of their great value. In the present article, he draws attention to the red gums — those with red or pink wood.

These trees, now fairly common in the Mediterranean region, can be used for making fine furniture with the precise appearance and value of mahogany. Furniture makers are afraid to use this wood, as the public considers eucalyptus wood to be worthless. There is no reason for this prejudice.

The species of *Eucalyptus* which can furnish red or pink wood like mahogany, and already commonly grown, are : — *E. rostrata* and a hybrid ; *E. algeriensis*, which is the cross *E. rostrata* × *E. rudis ; E. botryoides*, the pseudo-mahogany of the Australians, and a hybrid *E. botryoides* × *E. rostrata* = *E. Trabuti* Vilm ; *E. terreticornis* and its hybrids ; *E. rudis ; E. punctata ; E. diversicolor.*

All these species are easily grown in North Africa ; *E. algeriensis* has even become naturalised and is often found growing on the banks of watercourses in a semi-wild state.

On account of the present exhorbitant cost of furniture, it would be well worth while to give a better place to such a valuable wood which can be produced easily and cheaply.

LIVESTOCK AND BREEDING.

434 – **Stock Poisoning due to Oak Leaves.** — MARSH, C. D., CLAWSON, A. B. and MARSH, H., in the *U. S. Department of Agriculture, Bulletin 767*, pp. 36. Washington, April 18, 1919. HYGIENE

Although there is an abundant literature on poisoning caused by acorns, very little is recorded on poisoning due to oak leaves, and for this reason the authors took up the subject. The experiments were carried out on cattle, using the leaves of the scrub oak (*Quercus Gambellii*) and the following facts were observed :

Continuous feeding with oak leaves may produce a disease which sometimes ends fatally. In a herd feeding on the same pasture, only a few animals are affected. The most obvious symptoms are : — constipation, mucus and blood in the excreta, emaciation and oedema.

A diet composed solely of oak leaves is not sufficiently nourishing to allow of a normal increase of live weight. But, if other foods are added, they may constitute a maintenance ration ; 1.5 kg of alfalfa hay per head per day will suffice.

Oak leaves may be injurious in any season, but the cases of poisoning are mostly observed in spring, because there is a scarcity of other forage at that time and the animals find the young oak leaves appetising. Later on in the season, the animals continue to eat varying quantities of oak leaves, while still eating the other forage available, which causes still further trouble.

435 - **Stubbornness : a Note on Equine Pathology.** — Bianchi, G., in *Il Coltivatore*, Year 66, No. 6, pp. 158-160. Casale Monferrato, February 29, 1920.

The classic definition of stubbornness is the sudden stoppage of the animal without apparent cause in the middle of the a road, while neither kindness nor punishment can make it budge. Stubbornness, however, may assume many other forms, such as a refusal to start when harnessed, or to start again after a stoppage, etc. It is a redhibitory vice in contracts for the sale of horses and is usually ascribed to bad temper.

Professor Bassi has collected an enormous number of cases of madness and intractability in the horse due to cranial asymnetry. The author thinks that stubbornness and the phobias of the horse in general are, similarly, due to a pathological state of the vaso-motor system. In certain horses, either work, their first movements or some other cause, makes the circulation more brisk, and sight becomes dim and finally disappears; the horse stops, trembles, and is afraid to more forward until, when the circulation becomes normal, it loses its fear and starts work again. This explanation is confirmed by the fact observed by the author that 80 % of the horses afflicted with stubbornness have deficient sight; when the ophthalmia is cured, the stubbornness disappears.

436 - **Seroprophylaxia and Serotherapy for Tetanus in the Mule.** — Perucci, P., in the *Nuovo Ercolano*, Year XXIV, No. 12, pp. 145-148 ; No. 13-14, pp. 162-172 ; No. 15, pp. 176-180 Turin, June-August, 1919.

In Southern Italy, mules are not castrated as a rule. When, during the war, the Remount Commission found it necessary to buy large numbers of mules for war services the owners were obliged to have them castrated, which was done on a large scale, often by unskilled persons and without any antiseptic precautions. After some time tetanus naturally appeared, at first sporadically, then more frequently. The following neasures were employed to cope with this state of affairs :— 1) the sellers of mules were obliged to have them castrated by a veterinary surgeon ; 2) the use of anti-tetanus serum was made obligatory, as a preventive measure, for mules about to be castrated ; 3) immediate recourse to serotherapy was insisted upon in the case of animals affected by tetanus. These measures were quite successful and the cases of tetanus soon disappeared.

The author has studied the disease on the spot, he has contributed to the struggle to overcome it and he concludes from his observations and

xperiments that: — 1) the preventive dose of anti-tetanus serum found itable for the horse will also preserve the mule from infection by tetanus; this dose, using the Italian Military Veterinary Laboratory serum, from 5 to 10 cc., according to the strength of the serum; 2) the serotherapy of tetanus often cures the mule, if applied at the onset of the disease large doses of serum given in various ways (sub-cutaneous, endovenous);) with both the mule and horse, if a preventive dose of serum *given late* oes not suffice to protect it against tetanus, it will considerably change ie course of the disease, which will be easier to cure.

37 – **Spirochaetosis of Cattle in Brazil, and its Transmission by the Tick *Margaropus australis*.** — BRUMPT, A., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 10, pp. 748-757 + 1 Fig. Paris, December 10, 1919.

The author happened to discover bovine spirochaetosis during reseach one in France on the biology and pathogenic role of cattle ticks obtained om Brazil. This tick *Margaropus australis*), found in the Brazilian aughterhouses on normal cattle, produced thousands of embryos which fected a calf with a mixed piroplasmosis consisting of *Piroplasma bieminum* and *P. argentinum*.

Starting from the first ticks, the author obtained nine successive gerations on cattle. Certain lots of ticks lost their infection with *P. bieminum* at the third generation and their infection with *P. argentinum* the sixth. At the eighth generation, a cow was affected slightly with *pirochaeta Theileri*.

The pure spirochaetosis observed was extremely benign and adds to ie number of obscure diseases studied by C. NICOLLE and C. LEBAILLY.

Immunity, or rather tolerance, is quickly acquired; the thousands infectious embryos placed on the cow mentioned above had produced reaction whatever 75 days after infection.

The author points out that only the name of *Spirochaeta Theileri* averan (1903), parasitic on various mammals (cow, horse, sheep. buffalo. oat), should be retained, and the names *Spirochaeta equi* and *S. ovina* ould become synonyms.

38 – **Vaccination of Cattle against Anaplasmosis.** — LIGNIÈRES, J., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XXII, No. 10, pp. 765-774. Paris, December 10, 1919.

By choosing the least virulent *Anaplasma argentinum*, or those from ttle that have long recovered, and passing them successively and at ng intervals through the sheep and goat (1), such a fixity is attained in ie attenuation of the parasite that they can be used almost without danger ven for immunising cattle against natural anaplasmosis.

The author now uses this new method on all the breeding cattle in ie Argentine that are to be sent into regions where anaplasmosis exists.

(1) See *R.*, Febr., 1920, No. 220: "On Anaplasmosis: on Cattle Sheep and Goats are sceptible", by the same author. (*Ed.*)

439 – **Avian Typhosis and the Bacterophagus Microbe.** — D'HERELLE, F., in: I. *Comptes rendus de l'Académie des Sciences*, Vol. 169, No. 18 (Nov. 3, 1919), pp. 817-819; II. *Ibid.*, No. 20 (Nov. 17, 1919) pp. 932-934; III. *Ibid.*, Vol. 170, No. 1 (Jan. 5, 1920), pp, 72-75. Paris; IV. *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXII No. 30, pp. 1237-1239. Paris, Nov. 29, 1919; V. *Ibid.*, Vol. LXXXIII, No. 3, pp. 52-53. Paris, January 24, 1920 (2).

I. — ON AN EPIZOOTY OF AVIAN TYPHOSIS. — Once, installed in a region, avian typhosis becomes enzootic. It particularly affects adult fowls, which are more sensitive to it than pullets or aged animals. In France, it has decimated the poultry yards every year since 1916. It is impossible to foresee the duration of the enzooty for, besides the scarcity of information on the epidemiology of the disease, it has always assumed a more localised character in the United States, where it has long been known; therefore the conditions are very diverse.

If it is difficult to imagine measures for preventing the propagation of the disease by men, who carry the particles of virulent matter on the soles of their boots, or by animals who carry them on their feet, it is not the same with another method of dissemination described by the author This is as follows: certain poultry keepers in regions where the disease is rife, sell their stock as soon as the disease appears; the fowls are sent to the town markets and, though the majority are sold as food, it sometimes happens that fowls are bought for breeding, especially in the departments devastated by the war, and thus new centres of infection are set up.

II. — ON THE ROLE OF THE BACTEROPHAGUS MICROBE IN AVIAN TYPHOSIS. — The epizooty of avian typhosis mentioned previously enabled the author to make fresh observations on the role of the bacterophagus microbe in the genesis of diseases of intestinal origin.

In the intestinal content of any fowl, healthy or diseased, living in a normal or in an infected environment, a filter-passing bacterophagus microbe is always to be found. In addition, the presence of this normal intestinal guest is common to all the vertebrates, but its activity and virulence essentially varies in quality and quantity.

This bacterophagus microbe can be considered as the agent of a contagious disease attacking the bacteria; the bacterophagus microbe is to the pathogenic bacterium what the pathogenic bacterium is to the higher organism which it infects; the modalities of the action are comparable. The virulence of the bacterophagus microbe for *Bacterium sanguinarum* (the agent of avian typhosis) can only be observed in an infected medium; the absence of virulence is the absolute rule with healthy fowls and, on the other hand, with fowls that will succumb or have succumbed.

In a poultry yard where typhosis occurs, the disease occurs solely in fowls that contain in their intestine a bacterophagus microbe that is

(2) For other work by D'HERELLE on the filter-passing bacterophagus microbe that plasmolyses the bacillo of dysentery, see: *Comptes rendus de l'Académie des Sciences*, Vol. CLXV, p. 373, 1917; vlo. CLXVII, p. 970, 1918; Vol. CLXVIII, p. 631, 1919; Vol. CLXIX, p. 932, 1919; *Comptes rendus des Séances de la Société de Biologie*, Vol LXXXIII, No. 4, p. 97, Jan. 31, 1920. (*Ed.*)

nactive as regards *B. sanguinarum.* The animal is immune from the moment when the intestinal microbe acquires a bacterophagus power ver the pathogenic bacillus and the immunity persists as long as this ower remains sufficiently high to ensure the rapid destruction of the ba-illi ingested ; the ingestion of pathogenic bacteria with sufficient frequence onstitutes the chief factor in the maintenance of the activity of the bac-erophagus microbe as regards the bacillus under consideration ; the state f the contents of the intestine constitutes another factor. In the rare ases when recovery takes place this is invariably preceded by an increase n the virulence of the bacterophagus intestinal microbe for the pathogenic acillus. The author found that the bacterophagus microbe of a fowl hat recovered, spread in less than 3 days to all the fowls in the yard, vhich explains the sudden and apparently inexplicable arrest of the di-ease. The arrest always corresponds to the moment when a fowl recovers hat had been seriously affected.

All the facts quoted above have been reproduced experimentally.

The history of the disease ultimately records the history of the strug-le between the two agents ; the immunity is transmissible between indi-iduals of the same species ; the immunity is as contagious as the disease self.

The ingestion of a culture of the bacterophagus microbe that comes rom a highly virulent stock brings about the sudden cessation of the en-ooty on the same day as its administration.

III. — THE DEFENSIVE ACTION AGAINST INTESTINAL BACTERIA AND HE ETIOLOGY OF INTESTINAL DISEASES. — The author extended his re-earches to man, the monkey, cat, cow, pig, rabbit, rat, and duck, and ound in all the species, on the one hand the very frequent presence of ysenteric, typhoid and paratyphoid germs and, on the other, the constant resence of the bacterophagus microbe which, in the presence of an invad-ng organism, becomes rapidly accustomed to it and destroys it, whence he frequent abortion of diseases. In resistant inviduals, it becomes mmediately accustomed, while, in sensitive individuals, the adaption may s an exception, not take place, in which case, the disease declares itself.

One of the chief causes of the delay in the adaption of the bactero-hagus microbe to bacterophagy is probably some physical or chemical hange in the condition of the contents of the intestine in which the phe-omenon takes place.

IV. — ON THE BACTERIOPHAGUS MICROBE. — So far, the author has olated from various sources, strains of bacterophagus microbes that are ctive against the following bacteria :— The dysenteric bacilli of SHIGA, LEXNER and HISS, *B. typhosus, paratyphosus* A and B, *B. enteritidis,* og cholera bacillus, *B. Coli, B. Proteus, B. sanguinarum* Moore, and *B. ullarum.*

V. — ON THE CULTIVATION OF THE BACTERIOPHAGUS MICROBE. — The irulence of this microbe varies greatly from one stock to another, but its ction is always the same : all the living bacteria are attacked and when

the action is over, reinfections on any medium remain sterile. The best method for obtaining the bacterophagus microbe is as follows : —

To a MARTIN tube of peptonised broth, alkalinised to - 5 with phenophthalein, is added a concentrated emulsion of the bacillus on which it is desired to make the bacterophagus microbe act, an emulsion from a agar culture not more than 24 hours old ; this is then infected with a known quantity of a filtrate of the excreta to be examined for the bacterophagus microbe, and incubated at 37° C. If this microbe is present, the living bacteria are plasmolysed, which is shown macroscopically by the clearing of the medium. With a slight infection, the medium is limpid in 7 to 8 hours ; with a heavy infection, the action is much more rapid (1).

ANATOMY AND PHYSIOLOGY

440 – **The Mineral Metabolism of the Milch Cow.** — I. FORBES, E. B., BEEGLE, F. M., FRITZ, C. M., MORGAN, L. E. and RHOE, S., in the *Ohio Agricultural Experiment Station, Bullectin* 308, pp. 451-488.Wooster, Ohio, January, 1917. — II. FORBES, E. B., HALVERSON, J. O. and MORGAN, L. E., with the collaboration of SCHULZ, J. A., MANGELS, C. E., RHUE, S. N. and BURKE, G. W., *Ibid., Bulletin* 330, pp. 91-134, Sept., 1918.

The aim of the experiments described in this study, the second dealing with the same question (2), was to find whether mineral equilibrium can be maintained on rations containing the maximum quantities of mineral nutriment obtainable in common practical feeds ; to ascertain the effect of adding to these rations large amounts of calcium, magnesium and phosphorus in the form of supplements, such as inorganic salts ; and to explain the limited use made of mineral nutrients when consuming food ordinarily in liberal quantities.

The experiments were carried out with 6 Holstein cows in collection periods of 20 days, separated by intervals of 10 days. All the cows were in their 2rd, 3rd, or 4th lactation period. The milk produced varied from 38.7 to 58.35 lb. per head per day.

So as to provide a maximum of calcium, magnesium and phosphorus, a basal ration was used of clover or alfalfa hay (leguminous roughage) + maize silage + cotton cake + linseed cake + wheat bran. Maize flour (shown in the table as maize) was used as a source of carbohydrates. During the first experimental period, the variable constituent of the ration was the roughage and 3 cows were given clover hay and 3 were given alfalfa hay. During

(1) Mr. Tamezo HABESHIMA has found, in experiments on animals, that the bacteriolysate produced by the filter-passing bacterophagus microbe, when put in contact with the pathogenic bacillus, gives good results in preventive vaccination ; in addition, animals experimentally rendered germ carriers can be sterilised, as this principle is found in the gall-bladder after an intravenous injection. He maintains that the filter-passing bacterophagus microbe is not living matter but a sort of catalyst that can be extracted from the lysate by acetone or ether. The powder on the waxy deposit thus obtained has a much greater bactericidal power than the lysate itself. — *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIII, No. 8, pp. 219-221. Paris, February 28, 1920. (*Ed.*)

(2) The first study is summarised in *R.*, July, 1917, No. 648. A general summary of the results of this work and of the two papers abstracted above was made by FORBES, in the *Journal of Dairy Science*, Vol. II, No. 1, pp. 9-18. Baltimore-London, January, 1919. (*Ed.*)

the second period, the variable constituent was the salt, of which 3 cows were given twice as much as 3 others ; another variation consisted in giving calcium carbonate to 2 cows and precipitated bone flour to 3 others. A series of 17 tables contains : — the average food consumption per day ; the quantity of milk produced and the live weight of the cows ; the percentage composition of both food and milk ; the weight, in grams, of each constituent of the foods consumed and of the milk produced in one day ; the weight of the constituents of the urine and faeces ; the quantity of mineral constituents and nitrogen ingested daily and their metabolism ; the quantity of mineral elements in the daily ration expressed in cc. of normal solution ; the utilisation and elimination of the nitrogen ; the coefficient of digestibility of the rations ; the distribution of the unretained elements between the milk, urine and faeces. Some of the more important data are given in table I. See page 478.

The results are summarised below : —

The prevailing idea, that all animals whose ration consists in great part of leafy forage consume and digest the mineral elements in abundance, is not correct in relation to cows during the ordinary liberal milk production. With rations consisting of the ordinary farm foods, specially chosen to supply the maximum supplies of mineral nutrients, all the calcium, magnesium and phosphorus metabolisms remained negative, as in the previous year. On greatly increasing the calcium, magnesium and phosphorus content of the rations by increasing the quantity of food consumed and by adding large quantities of calcium carbonate and precipitated phosphate, all the calcium metabolisms and all the magnesium metabolisms save one were negative, but the phosphorus metabolisms became positive. This offers satisfying proof that, in improving milch cows by selection, we encounter limited capacities for digesting calcium, magnesium and phosphorus, and the incapacity for accumulating reserves of these elements before these limitations appear in their ability to digest and make use of the inorganic element. The authors suggest that a limited capacity for the formation of hydrochloric acid might be one of the limiting factors in the utilisation of the calcium, magnesium and phosphorus in the ordinary food and of the mineral supplements.

Doubling the usual dose of sodium chloride does not increase the retention of calcium, magnesium and phosphorus ; 1 oz., of salt per day per head provides sufficient sodium for cows yielding 45 lb. of milk per day, and a ration of 1-2 oz., of salt per head per day, according to the quantity of milk produced, suffices for the sodium requirements. Rations that contain sufficient sodium for the needs of the cow usually supply a proportionately great quantity of chlorine.

All the rations studied seemed to furnish sufficient potassium, and normal rations, therefore, probably contain enough for the cow.

The different circumstances that determine the way in which the food substances absorbed are eliminated have usually no corresponding effect on the retention of these elements in the organism. In some cases all the sodium excreted was in the urine ; in others, it was nearly all in the faeces. The same can be said of chlorine. The elimination of sodium and chlorine

TABLE I. — *Food consumption and milk produc*

	Daily rations, in grams	Distinctive characteristic of the ration	
Period I.			
Cow N° 2	Maize 3519 + cottoncake 469.2 + wheat bran 469.2 + linseed cake 234.6 + maize silage 13 636 alfalfa hay 5456 + salt 28.	Alfalfa hay	
Cow N° 3	Maize 3701.7 + cottoncake 493.6 + wheat bran 493.6 + linseed cake 246.8 + maize silage 11 940 + alfalfa hay 3180 + salt 28.	Alfalfa hay	
Cow N° 4	Maize 4092 + cotton cake 545.6 + wheat bran 545.6 + linseed cake 272.8 + maize silage 11 360 + alfalfa hay 3636 + salt 28.	Alfalfa hay	
Cow N° 1	Maize 4092 + cottoncake 545.6 + wheat bran 546.6 + linseed cake 272.8 + maize silage 13 636 + clover hay 4544 + salt 28.35.	Clover hay	
Cow N° 5	Maize 4092 + cottoncake 545.6 + wheat bran 545.6 + clover hay 4544 + linseed cake 272.8 + maize silage 13 636 + salt 28.	Clover hay	
Cow N° 6	Maize 4092 + cottoncake 545.6 + wheat bran 545.6 + linseed cake 272.8 + maize silage 13 636 + clover hay 4544 + salt 28.	Clover hay	
Period II.			
Cow N° 2	Maize 4092 + cottoncake 545.6 + wheat bran 545.6 + linseed cake 272.8 + maize silage 15 908 + alfalfa hay 7272 + salt 56.	Alfalfa hay	salt 56 gm.
Cow N° 3	Maize 4432 + cottoncake 590.4 + wheat bran 590.4 + linseed cake 295.2 + maize silage 13 636 + alfalfa hay 3636 + salt 56.	Alfalfa hay	salt 56 gm.
Cow N° 4	Maize 4092 + cottoncake 545.5 + wheat bran 545.6 + linseed cake 272.8 + maize silage 12 728 + alfalfa hay 4544 + salt 56 + bone flour 70.	Alfalfa hay and bone flower	salt 56 gm.
Cow N° 1	Maize 4092 + cottoncake 545.6 + wheat bran 545.6 + linseed cake 272.8 + maize silage 14 544 + clover hay 4644 + salt 28 + bone flour 70.	Clover hay and bone flower	salt 28 gm.
Cow N° 5	Maize 4772 + cottoncake 636.8 + wheat bran 638.8 + linseed cake 318.4 + maize silage 15 452 + clover hay 4544 + salt 28 + calcium carbonate 70.	Clover hay and calcium carbonate	salt 28 gm.
Cow N° 6	Maize 4092 + cottoncake 545.6 + wheat bran 545.6 + linseed cake 272.8 + maize silage 14 544 + clover hay 4544 + salt 28 + calcium carbonate 70.	Clover hay and calcium carbonate	salt 28 gm.

day averages); metabolism of 6 dairy cows.

yield of milk n.	Gain (+) or loss (—), in grams, of the body							
	Ingested sodium metabolised	Ingested potassium metabolised	Ingested calcium metabolised	Ingested magnesium metabolised	Ingested sulphur metabolised	Ingested chlorine metabolised	Ingested phosphorus metabolised	Ingested nitrogen metabolised
3622	25.638	188.684	84.263	29.876	30.617	51.883	37.894	280.504
	+ 9.140	+ 5.485	— 7.979	— 2.756	— 0,585	— 7.370	— 3.799	— 8.798
3640	20.077	132.899	52,292	24.624	22.963	38.553	34.498	226.040
	+ 4.254	+ 7.028	—11.262	— 2.035	+ 0.467	— 2,499	— 4.762	— 1.711
:0528	21.299	144.831	58.235	26.517	25.133	41.030	37.334	245.780
	+ 6.377	— 3.470	— 5.514	— 1.946	+ 0.861	— 2.660	— 1.601	+ 7.005
:7560	12.740	146.662	58.946	31.627	19.121	24,112	37.722	239.762
	+ 3.106	+ 2.340	— 7.352	— 3.111	— 0,134	— 1.736	— 4.028	— 8.365
18779	12.604	146.662	58.946	31.627	19.121	23.901	37.722	239.762
	— 0.467	+ 4.237	— 6.736	— 3.121	+ 1.374	+ 0.901	— 2.311	+ 6.357
20012	12.604	146.662	58.946	31.627	19.121	23.901	37.722	239,762
	+ 3.659	+ 7.841	— 7.563	— 2.329	+ 0.850	+ 1.944	— 2.210	— 5.645
26468	37.736	276.905	104.655	39.266	38.191	82.335	49.667	388.466
	— 1.495	+ 26.837	— 5.254	— 1.608	— 0.167	— 3.229	+ 5.395	— 8.195
23117	30.409	176.658	57.795	30.360	26.956	60.432	43.910	260.378
	+ 0.739	+ 14.482	— 6.639	— 2.161	+ 0.090	— 1.766	+ 2.894	— 0.115
21875	32.173	194.851	89.041	31.370	28.900	65.463	52.179	267.821
	— 1.099	+ 17.275	— 1.973	— 1.324	+ 0.823	— 0.644	+ 2.356	+ 1.808
20224	12.662	165.812	82.997	35.345	21.263	25.453	50.983	254.498
	— 5.394	+ 5.190	— 2.690	— 2.184	+ 0.401	— 2.587	+ 3.051	+ 0.799
20413	12.839	174.279	85.897	37.708	22.968	25.823	46.605	277.141
	— 2.559	+ 11.087	— 6.485	— 1.504	+ 2.542	+ 1.508	+ 4.002	+ 12.974
20441	12.662	165.765	84.778	35.066	21.002	25.360	41.587	253.683
	+ 2.089	+ 6.871	— 7.208	+ 0.270	+ 1.465	— 0.280	+ 0.700	+ 11.550

in the urine is increased when large amounts of these elements are ingested, by constipation, and by high water intake. In the cow, much more potassium is often excreted in the urine than in the faeces, but with rations characterised by the predominance of mineral acids, it was excreted in greater proportions in the faeces.

Cows excrete nearly all the calcium in the faeces, but if mineral acids predominate in the ration the quantity of calcium excreted in the urine may be slightly increased. There is always more magnesium than calcium in the urine, but the proportion in the faeces is usually four times that in the urine.

The phosphorus excretion is very similarly distributed to that of calcium, except that the phosphorus in the urine may be much increased by general physiological disturbance. Normally, 3 or 4 times as much sulphur is excreted in the faeces than in the urine, but, if large quantities are ingested, the sulphur content of the urine may be equal to that of the faeces.

Apparently, supplements of food or salts (sodium chloride, calcium carbonate or precipitated phosphate) have no effect on the quantity or composition of the milk.

No evident affect on the retention of mineral elements can be traced to variations in the ratio between acids and basic mineral elements as found in normal cow rations. A negative metabolism of the minerals may mean that a sufficiency was not ingested or that reserves previously accumulated were eliminated in the presence of a continuously superabundant ingestion. A negative and positive metabolism may, under certain circumstances, be only comparatively unimportant fluctuations in considerable reserves.

The nitrogen compounds in rations containing alfalfa hay are more digestible than the nitrogen compounds in rations containing clover hay; they are more completely absorbed by the intestine, but are more largely eliminated in the urine. The greater digestibility of the nitrogen in alfalfa, then, apparently does not show a corresponding nutritive superiority. The percentages of utilisation of the nitrogen compounds in the clover and alfalfa rations were the same. The deficient utilisation of the mineral elements by cows is of practical importance in the malnutrition of the bones of cattle, which is not uncommon after dry seasons and in over-stocked meadows, especially in regions with poor sandy soils or those of granitic origin, especially if these are exhausted by prolonged cultivation and insufficient manuring. This, again, probably implies the fairly common fact that, after a year of forced milk production, the cows quite often do not calve and numerous cows fed for high production do not maintain a high yield during consecutive lactation periods; it is probably one of the causes that contribute to the usual decrease in the milk yield as the lactaction period is prolonged. The most important observation arising out of this work is that under no circumstances was it possible to obtain an accumulation of calcium or a conservation of calcium metabolism in good milkers. It may be admitted, though it is not proved, that cows can

maintain a calcium equilibrium during a less abundant production of milk, but it is not known in what proportion the yield should be less in order to maintain the calcium equilibrium.

II. — This work shows that a heavy milker obtains the mineral constituents (especially the calcium) from the skeleton and that the cow cannot utilise a large proportion of the minerals in the food even when the basal ration is supplemented with more soluble calcium compounds.

As in the preceding experiments, 6 Holstein cows were used that yielded more than the average, but not exceptionally so ; all the cows were in their first lactation period. Each cow was fed for two experimental periods of 20 days, separated by an interval of 10 days during which the rations which were to be fed during the second period were adapted to their individual peculiarities. In 4 of the 12 periods, the number of days had to be decreased, on account of the irregular behaviour of the animals. In the first period, the basal ration per head per day was : — 11 lb. maize meal + 5 lb. nitrogenous concentrate. The average nutritive ratio was ; 1 : 5.72. In the second period, the alfalfa hay was increased to 18 lb. per day in order to satisfy the cows' appetite ; this, together with a change in the chemical composition of the alfalfa reduced the nutritive ratio to 1 : 4.5. With 3 of the cows, nothing was added to the basal ration during the first period, but, during the second period, they were given a supplement of calcium lactate (from 55.6 to 111.252 gm. per head per day according to how much the animal could take). The other 3 cows were given 70 gm. of precipitated bone flour per head per day during the first period and 40 gm. of calcium chloride during the second. The rations were those used for high milk production, except that succulent matter such as silage and roots was absent. The average daily production of milk was 47.2 lb. per head during the first period and 49.9 lb. during the second.

The data regarding each cow are given in a series of 16 tables and some of the most important figures are quoted in Table II see 482.

The results can be summarised as follows :—

The administration of precipitated calcium phosphate to cows when milking heavily and in periods characterised by the output of calcium in greater quantity than that assimilated, appears to result in the retention of appreciable quantities of the supplementary calcium and phosphorus, but the utilisation was very insufficient ; in fact, the mineral metabolism was usually characterised by a lack of economic utilisation of these constituents of the ration. Calcium lactate and calcium chloride were not assimilated, though the chlorine of the calcium chloride apparently was assimilated to a slight extent and led to an increased assimilation of the sodium in the ration. The different utilisation of the mineral constituents due to changes in the ration were in harmony with the nature of the change, i. e., an increased intake of an element was followed by an increased accumulation or a decreased loss of this nutrient but the response was usually so slight in comparison with the importance of the amount ingested, that it shows that the mineral metabolism of a well-fed good milch cow is not closely and directly dependent on the mineral constituents of the ration,

TABLE II. — *Food consumption and milk production*

	Daily rations, in grams.	Distinctive characteristics of the ration
Period I.		
Cow N° 1.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 7256 + salt 42.	Basal ration
Cow N° 2.	Maize 4967 + cottoncake 903 + linseed cake 903 + wheat bran 452 + alfalfa hay 7108 + salt 41.85.	Do
Cow N° 3.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 7256 + salt 42.	Do.
Cow N° 4.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 7256 + salt 42 + precipitated bone flour 70.	Basal ration + precipitated bone flour
Cow N° 5.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 7256 + salt 42 + precipitated bone flour 70.	Do.
Cow N° 6.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 7256 + salt 42 + precipitated bone flour 70.	Do.
Period II.		
Cow N° 1.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 354 + alfalfa hay 8164 + salt 42 + calcium lactate 11.252.	Basal ration + calcium lactate
Cow N° 2.	Maize 3743 + cottoncake 681 + linseed cake 681 + wheat bran 340 + alfalfa hay 7256 + salt 42 + calcium lactate 55.626.	Do.
Cow N° 3.	Maize 4209 + cottoncake 765 + linseed cake 765 + wheat bran 383 + alfalfa hay 6765 + salt 38.063 + calcium lactate 93.869.	Do.
Cow N° 4.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 8164 + salt 42 + calcium chloride 40.	Basal ration + Calcium chloride
Cow N° 5.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 8164 + salt 42 + calcium chloride 40.	Do.
Cow N° 6.	Maize 4989 + cottoncake 907 + linseed cake 907 + wheat bran 454 + alfalfa hay 8164 + salt 42 + calcium chloride 40.	Do

daily average); metabolism of 6 dairy cows.

Average daily yield of milk. gm.	Gain (+) or loss (—[1]), in grams, of the body							
	Sodium	Potassium	Calcium	Magnesium	Sulphur	Chlorine	Phosphorus	Nitrogen
23068	24.355	138.188	88.671	35.368	23.911	31.628	47.787	309.478
	+ 6.104	— 10.407	— 7.927	— 3.252	— 2.881	— 1.273	— 6.457	— 13.044
19389	24.147	136.099	86.950	34.904	23.597	31.450	47.342	305.699
	— 0.801	— 3.299	— 3.523	— 0.902	— 4.725	— 4.890	— 1.487	— 5.563
20244	24.355	138.188	88.671	35.368	23.911	31.628	47.787	309.478
	+ 6.994	— 5.560	—12.393	— 0.110	— 3.503	— 1.025	— 5.509	— 5.978
20841	24.537	138.188	105.788	35.811	24.160	33.029	59.114	309.573
	+ 6.430	— 6.501	— 9.807	+ 0.804	— 2.945	— 0.418	— 3.880	— 9.661
21642	24.537	138.188	105.788	35.811	24.160	33.029	59.114	309.573
	+ 2.509	— 2.356	— 5.193	— 0.158	— 3.176	+ 0.698	— 1.048	— 3.238
21261	24.537	138.188	105.788	35.811	24.160	33.029	59.114	309.573
	+ 4.589	— 0.868	— 2.997	— 0.118	—4.007	— 4.127	— 0.676	— 4.955
23261	21.432	294.503	121.319	29.393	34.722	53.751	54.608	386.598
	— 0.070	— 10.738	— 8.636	— 3.190	— 0.391	— 0.467	— 1.105	+ 26.242
15142	20.608	255.078	101.276	23.804	28.991	50.204	43.691	318.968
	+ 1.547	+ 9.120	— 7.712	— 0.910	— 0.177	— 0.740	— 0.418	+ 20.847
18552	19.075	245.069	100.503	24.631	28.995	46.631	45.802	323.318
	+ 1.090	— 0.111	—16.506	— 3.778	— 3.100	— 1.713	— 4.107	— 12.311
22002	21.381	294.488	120.109	29.384	34.708	79.412	54.608	386.499
	+ 3.526	+ 6.415	—11.660	— 2.840	+ 0.293	+ 2.348	— 1.968	+ 23.940
22696	21.381	294.488	120.109	29.384	34.708	79.412	54.608	386.499
	+ 3.933	+ 6.670	— 8.699	— 2.401	— 0.599	+ 1.261	— 1.020	+ 25.373
22086	21.381	294.488	120.109	29.384	34.708	79.412	54.608	386.499
	+ 3.041	+ 9.119	— 8.412	— 2.984	— 0.218	+ 1.860	— 0.836	+ 23.856

but that its nature is determined, under normal conditions, firstly by the inherited impulse to secrete milk, secondly by the mineral food reserves of the animal body, and thirdly by the food supply.

The most important result of this experiment showed that the limited utilisation of mineral food, particularly of calcium compounds, is not primarily determined by their solubility.

Common salt, at the rate of 42 gm. per head per day, is sufficient for sodium accumulation, but provides insufficient chlorine. Chlorine was not accumulated until it was given as a supplement in the form of calcium chloride.

The metabolism of potassium shows that a ration should contain abundance of roughage in order to maintain the metabolism of that element, that is, unless silage is used it is not always possible to conserve the potassium reserves of the organism, but it is true that under certain circumstances it cannot be ascertained whether a negative potassium metabolism means an actual lack of that element in the ration or simply unimportant fluctuations in the body reserve.

In this experiment, the ingestion of sufficient protein to provide nitrogen accumulation did not suffice to conserve the sulphur equilibrium. In spite of a general harmony in the metabolism of both sulphur and nitrogen, such as might be expected from their combination in the proteins of the food, there is a certain independence in the metabolism of these two elements.

In spite of a superabundance of calcium, magnesium and phosphorus in the rations, the metabolism, of calcium and phosphorus was negative in every case, while with magnesium 11 metabolisms out of 12 were negative.

Two of the chief facts that determine how sodium, potassium and chlorine are eliminated are their ready solubility and the length of time the food residues remain in the digestive apparatus. The chlorine of the calcium chloride was eliminated in the urine and the calcium in the faeces. The calcium and phosphorus were almost entirely eliminated in the faeces; the urine contains very little of either of them, but milk contains large amounts of both (always more calcium than phosphorus) and a larger proportion of the phosphorus than of the calcium in the food.

Magnesium was excreted in the urine in much greater quantities than either phosphorus or calcium. In 8 out of 12 cases, more magnesium was eliminated in the urine than in the milk; in 11 out of 12 cases the total excretion of magnesium was greater than the amount supplied. Similarly, sulphur in every case was eliminated in greater quantities in the urine than in the milk; in 11 out of 12 cases the quantity excreted was greater than that ingested. The quantity of sulphur ingested has a great influence on the distribution between the urine and faeces of the sulphur excreted.

The quantity of nitrogen retained depends closely on the amount ingested, but is not closely connected with mineral metabolism. An increased ingestion of nitrogen, up to a certain limit, causes a proportionate increase in retention and this increase is in proportion to the total quantity of nitrogen excreted in the urine.

441 – **Contribution to the Physiology of Calcium and Phosphorus Metabolism in Relation to Milk Secretion.** — Meigs., E. B., Blatherwick, N. R. and Cary, C. A., in the *Journal of Biological Chemistry*, Vol. XXXVII, No. 1, pp. 1-75 + 4 Fig. Baltimore, January, 1919.

Work carried out by the Dairy Division of the U. S. Department of Agriculture. A description and a discussion are given of experiments carried out with 15 milch cows and in which the phosphorus content and, in some cases, the calcium content of the blood were estimated at intervals during the periods of normal growth, gestation and lactation or during shorter periods under experimental conditions.

Two milkers and two dry cows were used for studying the precursors in the blood plasma of the phosphorus and fat in the milk. The method used was to obtain approximately simultaneous samples of blood either from the jugular vein or from the subcutaneous abdominal vein and to estimate the total phosphorus, the phosphatids and inorganic phosphorus in the blood and plasma of the samples.

The blood in the jugular vein had not passed through the mammary glands, while that in the subcutaneous abdominal vein had passed through them.

When the mammary gland was active and the experiment made without disturbing the animal too much, there were less phosphatids in the abdominal plasma than in the jugular plasma. No essential differences were observed in the inorganic phosphorus content of the plasma of milking and dry cows, in both of which the milk vein contained more than the jugular vein. It was impossible to show the existence in the plasma of any other phosphorus compounds save phosphatids and inorganic phosphorus.

The following conclusions were reached : — The fat and phosphorus in the milk are derived from some phosphatid (one or several) present in the blood. This phosphatid is converted in the cells of the mammary gland into an inorganic phosphate and a neutral fat ; it yields 2.5 or more parts of phosphorus to 45 parts of fat. As the milk only contains about 1 part of phosphorus to 45 of fat, about 60 % of the phosphorus that enters the mammary gland as the phosphatid that precedes the milk fat, must return to the blood as an inorganic phosphate. A slight psychological disturbance is sufficient to stop the absorption of the phosphatid by the mammary gland. The speed with which the phosphatid is absorbed explains the daily production of the fat in the milk. If this was derived, even only in part, from the fat in the blood, it would be difficult to explain how the inorganic phosphorus returns to the blood.

The relation between the age and the quantity of phosphorus in the blood was studied in 5 cows. During the first few days after birth, the phosphorus contained in the blood corpuscles was about double that in older animals, but the difference rapidy diminished and at 4 months was hardly perceptible. The phosphatid in the plasma of newly-born calves was at first present in minimum quantity, then gradually increased during the first year. The inorganic phosphorus in the plasma was fairly high at birth, attained its maximum at 6 months, then decreased.

Two cows giving their maximum yield of milk were used to study the effect of a decreased weight of food on the phosphorus of the blood. The total phosphorus in both blood and plasma, the phosphatid and the inorganic phosphorus in the plasma, the total phosphorus in the corpuscles and the relative volume of the corpuscles all diminished during the period of reduced feeding and revert to their previous quantity when abundant food is given again. During the reduced feeding there was a fairly clear inverse ratio between the concentration of the phosphatid in the blood and the daily yield of milk. The authors explain this by supposing that the phosphatid was introduced into the blood during that period in an almost constant proportion and that. consequently, its concentration in the blood varied inversely to the speed at which it was excreted in the milk.

The administration of disodium phosphate with the food tends to increase the phosphate concentration in the plasma, while the administration of calcium chloride tends to diminish it. This latter fact can be explained by the well-known effect of the ingestion of calcium on the excretion of phosphorus.

The phosphorus content of the blood and plasma probably diminishes towards the end of gestation, even if increased phosphates are given in the ration. Possibly in-calf cows are able to utilise a greater quantity of phosphates than is usually given in the food.

During the first month of lactation, the phosphatid of the plasma tends strongly to increase, then remains at a relatively high amount thoughout the entire lactation period. This phenomenon was largely independent of the food, and the authors think it is connected with the tendency of the fats of the reserve tissues to pass into the circulation at the beginning of lactation.

The concentration of the calcium in the blood is very constant ; slight increases were obtained by giving calcium chloride in the food. The authors consider that the chief factor that influences the calcium content of the blood is acidosis.

FEEDS AND FEEDING

442 – **Apple Cake or Powdered Apple Refuse.** — REMONDINO, C., in *Il Coltivatore*, Year LXV, No. 34, pp. 759-760. Casale Monferrato, December 10, 1919.

In the province of Cuneo, Italy, a co-operative society has been established for the preparation of fruits, particularly in the dry state, by means of the best modern methods. This in done in the factory opened in Cuneo by thermo-electric machines.

In preparing apples, they are sorted into 3 grades : —

1) fine and large ; 2) medium ; 3) small or green, or beginning to spoil. The apples of the first grade are peeled, the heart is removed and they are sliced, dried and packed in boxes.

The second grade apples are used for cider making, which is then either consumed or passed over fresh pomace to make " piquette " ('small' cider) or fermented to make dry cider.

The third grade apples are mixed with the by-products of the other grades, dried and ground, thus giving a powder well suited for rearing stock

It is given to calves at the rate of a pound per head per day, and when tested practically has always given excellent results. This apple powder has the following percentage composition: — Water, 8.48; fats, 3.88; ash, 7.18; nitrogenous matter, 7; fibre, 19.05; and nitrogen-free extract, 51.41 %.

443 – **The English Thoroughbred in Italy.** — Moreschi B., in *L'Italia agricola*, Year 56, No. 10, pp. 305-316 + 3 Figs. Piacenza, October 15, 1919. HORSES

There are not many more than 30 breeders of English thoroughbreds in Italy and over two-thirds of these are in Upper Italy.

In the spring of 1919, amongst the State stallions, there were 77 English pure-breeds, of which 41 (55 %) were born in Italy and 36 came from abroad — 24 from England, 11 from France and 1 from America. The English thoroughbred represented just over 7 % of the 1106 State stallions that were in use in 1919.

There has been a rapid and progressive diminution in the proportion of thoroughbreds in the deposits :— 14.16 % in 1890; 13.07 % in 1899; 12.11 % in 1904; 11.20 % in 1912; 10.28 % in 1914.

The 77 that were employed in 1919 were distributed as follows to the various deposits: — Crema, 4; Ferrara, 6; Reggio Emilia, 17; Pisa, 18; Santa Maria di Capua, 13; Catania, 19. The deposit at Ozieri (province of Sassari), which serves Sardinia, has none now, as horse-breeding in the island has a decided tendency towards the Arab type, which has always given excellent results.

Thoroughbred horses are less common in northern Italy, more common in central Italy and still more common in southern Italy and Sicily. In Sicily, they are used for producing Anglo-Arabs, which are said to be more robust than the Arab and less exacting than the English horses, with true and harmonious proportions and large, well-attached muscles.

444 – **The Escutcheon of Dairy Cows.** — Hooper, J. J., (Kentucky Experiment Station) in the *Breeders' Gazette*, Vol. 76, No. 2, pp. 52-53. Chicago, July 1, 1919. CATTLE

Short discussion on the shape of the escutcheon of 1019 dairy cattle examined by the author and J. W. Whitehouse at the Kentucky Agricultural Station. They found that the "Flandrine" type of Guénon is dominant in the Holsteins (66 %), Guernseys (54 %), Kerry (68 %) and in the few Ayrshires examined (92%) whilst the "Selvedge" type was commoner in the Jersey (40 %). The average of the yields of registered Jersey cows shows that cows with a shape of escutcheon theoretically corresponding to a lower milk yield, whether of the "Flandrine" or "Selvedge" type, give more milk and butter than cows with an escutcheon theoretically of the first class of the corresponding type. The author concludes that the escutcheon is more or less a characteristic of the breed and that its size and shape are of little if any importance in selecting dairy cattle.

445 – **Sheep Breeding in Hanover, Germany.** — Koster, in the *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 23, pp. 319-324. Berlin, June 7, 1919. SHEEP

Sheep fattening has long been an important branch of stock rearing in the Leine valley, Germany. As the production of wool and meat

TABLE I. — *Gain in weight in kg. on fattening the cross Leine × Oxford.*

N° of each animal	Initial live weight on 30.I	Gain in live weight on the following dates: 13. II	25. II	12. III	25. III	9. IV	23. IV	7. V	21. V	4. VI	18. VI	2. VII	16. VII	30. VII	Total gain in live weight	Total live weight
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
155	11.5	4.5	4	4	3.5	3.5	4	3	3.5	4	1.5	0	0	1.5	37	48.5
301	8	3.5	4	4.5	4	4.	5	3.5	3.5	3.5	1.5	1.5	2	2.5	43	51
45	13	3	5.5	4.5	3	4.5	4.5	2.5	2	3.5	2.5	1.5	2	2	41	54
404	9	5	4	4.5	3.5	6.5	3.5	5.5	1.5	1.5	3	0.5	0.5	1.5	44	53
381	8	3.5	4.5	3.5	1.5	6.5	4	3	2	1.5	2	1.5	1.5	1.5	36.5	44.5
405	7	2.5	3.5	3.5	3	3.5	5.5	2	2.5	3.5	0	2	2.5	1.5	35.5	42.5
310	9	4	5	3.5	4.5	5.	5	3	3.5	3	3.5	0	1.5	1.5	43	52
353	9	4	4	3	4	3.5	4	3	2.5	3	3.50	1.5	2	0	38	47
395	9.5	3.5	3.5	4.5	4	3.	4.5	3	2	3.5	4	1	2.5	0.5	39.5	49
349	10	4.	4.5	3.5	3.5	5.	4	3	1	4	3.5	2	1.5	2	41.5	51.5
345	7.5	3.5	4.5	4	3.5	4.	3.5	3	3	2.5	3.5	1.5	1.5	0.5	38.5	46
386	9	4.5	3.5	4.5	3.5	5.	5	5	2.5	3.5	3	3	2	0.5	45.5	54.5
323	7.5	4.0	3.5	3.5	4	3.5	3.5	2	2	2	1	2.5	1	0.5	33	40.5
325	9.5	4	3.5	4.5	2	3.5	4.5	2.5	1.5	2.5	2	2	0	2	34.5	44
446	7	3.5	3	3	3	4.5	6	5	0	3	4	2	1	0.5	38	45
Total gain in live weight	134.5	57	60.5	58.5	50.5	65.5	66.5	49	33	47.5	38.5	22.5	21.5	18.5	588.5	723
Increase %		9.68	10.28	9.94	8.58	11.13	11.3	8.32	5.61	8.07	6.54	38.2	3.65	3.06		
Average live weight per head	9	13	17	20.5	24	28.5	33	36	38.5	41.5	44	45.5	47	48		
		4	4	3.5	3.5	4.5	4.5	3	2.5	3	2.5	1.5	1.5	1		

	12 weeks = 84 days	8 weeks = 56 days	6 weeks = 42 days
Average increase in each period	24 kg.	11 kg.	4 kg.
» » per had in each period	4 »	2.75 »	1.335 »
» » per had per day	0.285 »	0.195 »	0.95 »
Relation of gain in the 3 Periods	3 » :	2 :	1 »

Total live wt. 723 kg.; per head 48.2 kg. — Dead wt. 371 kg.; per head 24.735 kg. = 51,3%.

are of great importance in Germany now, the author has collected the results obtained in Hanover with suitable crosses between the local breed (Leineschaf) and an English mutton breed. The Leine sheep is a good milker, wich can feed its lambs for 6 months or more, but its wool is coarse and scanty and the lambs are not early maturing. The cross-bred lambs, however, can be fattened after the 10th. week, if the proper precautions are taken for fattening such young animals. The results obtained by crossing with the Oxford are given in Table I. The total fattening period can be divided, according to the results obtained, into three sub-periods, the first of 12 weeks, the second of 8 and the third of 9, during which the gain in weight is according to the ratio 3 : 2 : 1.

During the same experiments, the gains in weight were notified of 6 rams, 6 wethers and 6 ewes as well as of 6 rams respectjvely belonging to the Oxford, Hampshire and common breeds.

The results are given in Table II.

TABLE II. — *Gain in weight of various sheep.*

	Initial weight	Days of fattening	Gain in weight	Gain per head per day
	kg.		kg.	kg.
6 rams	67	140	218	0.26
6 wethers	67	140	200	0.235
6 ewes	69	140	192	0.25
6 Oxford rams	—	105	171	0.28
6 Hampshire rams	—	105	167	0.265
6 common rams	—	140	218	0.26

TABLE III. — *Wool produced and scouring results from the cross Leine Dishley × Merino (in kg.)*

	1916	1917	1918	1919	
Extra first quality	—	—	—	75.2	995.3
First quality	45.2	379.4	859.1	920.1	
Second »	1 146.5	1 090.1	677.0	722.7	
Third »	470.0	168.5	47.3	69.2	
Fourth »	24.0	18.0	—	—	
Waste and impurities	95.0	43.1	28.9	106.2	
Total scoured wool	1 780.7	1 699.1	1 612.3	1 893.7	
Yield per cent	48	50.8	44.5	45.1	
Dirty wool,	3 726	3 327	3 621	4 194	
No. of sheep clipped	1 212	1 027	1 065	1 081	
Dirty wool per sheep	3.075	3.25	3.40	3.88	
Scoured wool per sheep	1.46	1.65	1.51	1.75	
Value of wool, in francs	10.9	13.9	16.27	29.675	

As regards the results obtained in improving the quality and yield of the wool, the results given in Table III were obtained by crossing the local Leine with the Merino-Dishley.

The results in Table III show that by 1919 the third quality wool which is characteristic of the Leine breed had almost completely disappeared, thus showing the improving influence of the Merino-Dishley cross on the quality of the wool in successive crosses. As well as these general results, those relating to each animal are given (Table IV) and show the large individual variations.

TABLE IV. — *Wool yield (in kg.) of each cross-bred ewe.*

1918			1919			1919 Floch of mother ewes		
						2	ewes	2.5
						12	»	3
						20	»	3.5
18	lambs	3				44	»	4
40	»	3.5	20	lambs	2.5	48	»	4.5
73	»	4	84	»	3	52	»	5
71	»	4.5	96	»	3.5	37	»	5.5
34	»	5	42	»	4	37	»	6
11	»	5.5	23	»	4.5	14	»	6.5
2	»	6	5	»	5	2	»	7
249	lambs	**4.5** kg (av.)	**278**	lambs	**3.5** kg (av.)	**275**	ewes	**5** kg (av.)

TABLE V. — *Results obtained in another rearing.*

1919			1919	
			Number of ewes	
			1	1.5
			5	2
			27	2.5
13	lambs	1.5	58	3
24	»	2	60	3.5
15	»	2.5	72	4
30	»	3	32	4.5
9	»	3.5	10	5
8	»	4	3	5.5
99	lambs	**2.6** kg (average)	**268**	ewes **3.6** kg (average)

The author also deals with the market demand for lambs for fattening and wool-producing at the age of 3-4 months ; they are bought by farmers with good intensive pastures where they are fattened up to 60-70 kg., with a yield of wool that is normally 5 kg.

446 – **Dried Carrots as Food for Pigs.** — Badoux, F., in *La Terre Vaudoise*, Year XI, N. 47, pp. 420-421. Lausanne, November 22, 1919. PIGS

The author was asked by the "Société Vaudoise d'Agriculture" to test the food value of dried carrots for pigs. Three groups of pigs were selected and group A served as control, B received a medium ration of dried carrots and C received a heavy ration. The rations always contained the same amount of digestible nutrients; they were as follows:—

Foods	Group A 1st and 2nd week	Group B		Group C	
		1st week	2nd week	1st week	2nd week
Potatoes . . . . . kg.	2.000	1.600	2.000	1.300	2.000
Maize . . . . . »	0.450	0.500	0.250	0.550	0.130
Haricots . . . . . »	0.300	0.300	0.200	0.270	0.140
Barley . . . . . »	0.200	0.200	0.200	0.200	0.100
Rye . . . . . »	0.100	0.100	0.100	0.100	0.100
Cake . . . . . »	0.100	0.050	0.100	0.050	0.070
Dried carrots . . . . . »	—	0.200	0.500	0.300	1.000
Nutritive ratio . . .	1 : 6.25	1 : 6.25	1 : 6.23	1 : 6.25	1 : 6.24

The cost of the ration for each of the three groups was respectively 92, 93 and 92.5 centimes per day per head with the following prices per kilo: Potatoes, 15 ct.; maize, 50 ct.; haricots, 53 ct.; barley, 64 ct.; rye, 60 ct.; cake, 50 ct.; dried carrots, 32 ct.

The increase in live weight was 230 gm. per head per day and was equal in the three groups.

The results were satisfactory on the whole and show that dried carrots are suitable for fattening pigs, especially as, regarding the experimental groups (contrary to the control group), the rule was intentionaly neglected that once a fattening ration is chosen it should not be changed, otherwise the utilisation of the nutrients greatly decreases.

Light-coloured dried carrots are much richer in food material than dark-coloured ones, and contain an average of: Protein, 7.1 %; fat, 1.1 %; sugars, 34.5 %; moisture, 21.8 %. Pigs are very fond of them and the best ration is 500 gm. for pigs weighing 50 kg.

447 – **Citrus Peel as Food for Pigs.** — Allen, R. S., in the *Maryland State College of Agriculture, Agricultural Experiment Station, Bulletin* 227, pp. 193-202. Maryland, March, 1919.

Garbage constitutes a good food for pigs, chickens and sheep but chiefly for pigs. It usually consists of 16 % of animal matter, 70 % of vegetable matter, 5 % of unutilisable matter, and usually contains approximately 70 % of water, 20 % of solid matter, 3.5 % of fat, 1.5 % of bone, and 5 % of useless matter. The best rate at which to feed it to pigs is 20 lb., per head per day and, for hygienic reasons, it should be cooked first.

Pigs will not eat the raw peel of citrus fruits, and it is generally supposed that cooking leads to the formation of a substance poisonous to pigs. The author was asked by the National Research Council to find whether this belief is correct, and accordingly experimented on 4 groups of 3 pigs each at the Maryland Experiment Station. Each group was given maize flour, linseed cake + tankage in the proportions of 94 : 3 : 3. One group received no other food and served as control ; the others were respectively given large quantities of the cooked peel of oranges, lemons and grape fruit. The peel was about ⅓ of the total food consumed. The test with the group given grape fruit had to be stopped after 40 days, as no more was available ; that with the two other groups lasted 90 days. A table gives the weight of the animals every 10 days. No toxic effects were observed. The control group ate 10.5 lb. of food for each lb. of weight gained ; the group that ate orange peel ate 6.7 lb. of the basal ration and the group that ate lemon peel ate 5.7 lb. If this peel is available it is best used by cooking it and feeding it to pigs.

POULTRY

448 – **Ostriches in North Africa.** — RIVIÈRE, C., in the *Revue agricole de l'Afrique du Nord*, Year XVIII, No. 25, pp. 51-54. Algiers, January 16, 1920.

The Berbery ostrich (*Struthio camelus* Lin.), the finest existing ostrich, belongs exclusively to North Africa. Attempts to domesticate it have long been made in that region and the author sums up the attempts made from 1868 up to the present, attempts which have all failed.

The failures in Algeria and elsewhere are largely due to the bad origin of the breeding animals. Then the marine climate of North Africa, especially on the littoral, where the runs had been established, is apparently unsuitable for the production of fine feathers.

The right place for the industrial exploitation of the ostrich in North Africa is the extensive steppe regions whose air and soil are both dry, where the grassy covering has some temporary value ; there it is that the plumage acquires all its qualities and the bird keeps its vigour, for damp and bad weather are injurious to it.

In 1888, the author had the idea of populating the southern regions on the Sahara border by transporting there all the breeding pairs from the experiment gardens and ostrich farms in Algeria, and confiding them to the care of the Djemmas (a sort of administrative council of the southern tribes), who would have reared them by changing their pastures. However, this idea never matured on account of financial difficulties.

As regards the state of the ostrich farms in Algeria, Tunisia, Morocco and even in Madagascar (1), the author affirms that '" for many years now, in spite of failure upon failure, they remain still at the stage of hope and..... expense ".

The unfavourable conditions that apparently are opposed to economic rearing in all North Africa are summarised by the author as follows :

(1) For ostrich-rearing in Tunisia, see *R.*, 1911, No. 1483 ; in Madagascar, see *R.*, 1910 p. 144 ; *R.*, May, 1911, No. 1484 ; *R.* August, 1914, No. 757. (*Ed.*)

The cock Berbery ostrich has long white plumes in the wings and tail and these are the most in demand. Those of the hen, generally grey, are much less valuable.

Egg-laying only takes place in periods, every 2 days, in winter and summer. There are from 30 to 40 and even as many as 60 eggs. The eggs are usually hatched by both the parents, but the cock often takes a more active part in incubation, which lasts from 42 to 45 days and good hatchings give a dozen chicks which are easily reared by the parents. Thus, many eggs are lost and, unfortunately the eggs of this race cannot be hatched artificially; the rapid development of ostrich farming in South Africa is largely due to the fact that the eggs of the ostrich there can easily be incubated artificially.

The existing difficulties in the way of ostrich farming are :

1) The difficulty, even the impossibility, of obtaining breeding animals of a good type.

2) The difficulty of using artificial incubation with the Berbery race.

3) The difficulty of cheap stabling and maintaining a good sized flock which, before the war, cost 170 francs per pair per year (in the Cape, the annual gross revenue was 150 to 200 fr. per pair).

4) The income is only from the feathers ; the sale of the eggs for food is of slight importance.

5) The food for a fine breeding pair consists per day, of 500-600 gm. of various grains, about 20 kg. of green food and 8 litres of water.

It would be difficult to realise these conditions in the steppe regions, where only the dry climate is favourable to the feather-bearing ostrich.

The necessary technique for obtaining a good yield by natural incubation has been accurately ascertained at the Algiers Experimental Garden.

The author gives no definite conclusion and limits himself to explaining the situation, but past experience seems definitely against practical ostrich farming in North Africa.

449 – **Trial of a System Consisting in Keeping Two Queens in Each Hive.** — SLADEN, F. W., in the *Agricultural Gazette of Canada, Dominion Ministry of Agriculture*, Vol. 6, No. 2, pp. 140-142 + 3 Fig.s Ottawa, February, 1919. BEE-KEEPING

As it would be of great utility to find an efficacious method for preventing swarming without too much work, the author tried to solve the problem by keeping 2 queens in each hive for 11 months of the year. He found that this is a practical method and will try it again in 1919.

Two young queens, separated by a double partition of wire gauze, were wintered in a hive in a cellar from 1917-1918. When the dandelion flowered, the bees and queen from one side of the gauze were removed to another hive ; in this way swarming was avoided and the two queens gave a uniform and increasing production of young bees, thanks to which, two strong hives were obtained in time for the flowering of the clover. The number of bees was much greater than the number which began the season with one queen. These bees yielded 480 lb. of honey.

In order to avoid swarming when the clover flowers, and to obtain two queens again in each hive (all the following operations were carried out in

several colonies), the author removed the old queen from the brood chamber when the clover flowered and, 8 days later, destroyed all the royal cells save two, one on each side of the metal gauze. A special porch fixed in front of the hive separated the entrances to each half by 8 inches. This was done to avoid the possibility that the queens leaving their cells might meet on returning from their nuptial flight. These hives did not swarm.

450 – **Sizes of Frames for Hives.** — JUNGFLEISCH, C., in *L'Apiculteur*, Year 64, No. 2, pp. 33-34. Paris, February, 1920.

The arrangement of the hive depends on the purpose for which it is intended. To obtain honey in sections, the frames must be low, so as to force the bee to climb up. High frames, or rather frames superimposed vertically, are better suited for honey for extraction, as they help the bee to store its provisions above the brood chamber, as it tends to do naturally.

In rich honey-districts very large frames are said to be needed, while small frames suit poor districts. But the author points out that the conclusion is erroneous, since large hives with large numbers of bees are wanted everywhere and while the hives can be numerous in rich districts, they must inevitably be few in number in poor districts.

Some time has passed since a Bee-Keeping Congress tried, without success, to clear up the question as to the size of the frames. However, there are certain shapes which may be described as classic: the low frame, 30 × 40 cm.; the high frame, 30 × 40 cm.; the square frame, 33 × 33 and 35 × 35 cm; and the frame 42 × 27 cm., very common in France owing to the importation of American hives. All these frames are large (about 12 sq. decimetres in area) and are only used for the brood chamber; the frames of the sections are only ½ or ⅓ the height of the hive frames. The divisible hive, with superimposed sections, which has become more common of late, has led to the adoption of smaller frames which may be either high or low: 35 × 25 cm.; 30 × 30 cm.; 30 × 25 cm.; etc. All these refer to inside dimensions in centimetres.

Again, bee keepers are not agreed as to how the frames should be measured. The internal dimensions are nearly always given, but the author observes that as the external dimensions alone fix the size of the hives, extractors, etc., they are the only ones that should be given.

451 – **The Boulonnaise Hive with P. Chiris Frames.** — HIBON, C., in *L'Apiculteur*, Year 64, No. 2, pp. 35-36 + 2 Figs. Paris, February, 1920.

This hive only differs from other mobile hives by the arrangement of its brood chamber. The hive consists of four panels mounted on a board and, the 2 vertical gables to which are nailed the board and the pont and rear walls, inclined at the same angle as the P. CHIRIS frame _/ adopted for the brood chamber. Each of the inclined walls stops 25 mm. from the board, but is continued by a small, movable plank which slips along the outside of the wall and rests on the board. In front, this small plank does not come down to the board, but rests on a notched stick in which is a hole to allow the bees to pass.

The board has two slopes, inclined in such a way as to throw the debris falling from the combs towards the movable planks in the front and rear, so that cleaning is easily carried out by lifting these planks. The median ridge carries a metal rack which keeps the bottom of the frames in position, the tops being kept in place by bent nails fastened in notches on the edges of the walls.

The roof consists of a rigid panel, with tongued joins to prevent warping and fits on the body of the hive, directly on the walls, which have no ledges.

The brood chamber contains 10 frames with some 8 sq. decimetres of available surface. The capacity is not much more than 30 litres. In order to adapt the hive body to the square VOIRNOT, it was found necessary to make it of these dimensions.

452 – **To Preserve Frames from Moth.** — PATAY, in *L'Apiculteur*, Year 64, No. 1, p. 30 Paris, January, 1920.

To preserve sections not in use, they are placed in a well-ventilated room ; in each section, between the frames, is placed a small piece of absorbent cotton wool soaked with cinnamon oil. The author kept his sections perfectly in this way for three years. The bees seem to be unaffected by the smell of the oil. The author intends to place the cotton wool in all the coverings and roofs. If a swarm dies, the combs will be found intact and free from the larvae or moths of *Galleria mellonella*. If this is successful, it will provide a valuable means of defense for a weak swarm. Very little oil is required for an entire apiary.

453 – **Ants as Enemies of Bees and Hives.** — TINAYRE, J., in *L'Apiculteur*, Year 63, No. 11, p. 267. Paris, November, 1919.

Most treatises on apiculture suggest that ants are more a nuisance than harmful to bees. The author, however, has found that hives placed near woods are exposed to dangerous invasions by ants, especially in early spring. Unless closely watched, the ants, starved after their winter seclusion, will impoverish the hives in numbers and food.

It is difficult to deal with ants when the hives are near a wood, for as soon as one ant-heap is destroyed another is formed. They can, however, be opened with a pick and burnt out with paraffin. In addition, the base of the supports of the hives should be surrounded by fine wood ashes, as ants cannot climb up this ; the ashes should be renewed after the slightest rain.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

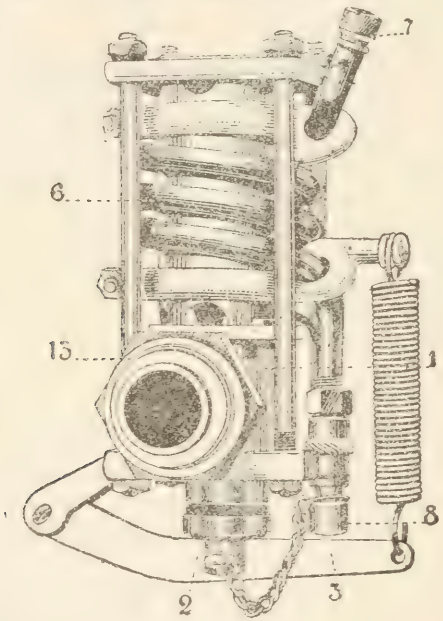
454 – **Protection of Tractors against Freezing.** — PASSELÈGUE, G., in the *Journal d'Agriculture pratique*, Year LXXXIV, New Series, Vol. 33, No. 4, pp. 72-73. Paris, January 22, 1920.

Serious accidents, such as cracked radiatiors or cracked water-jackets of the cylinders — accidents that not only mean expensive repairs but make the machine unusable for some time — are caused by the freezing of the cooling water of tractor or automobile engines.

The simplest way to avoid this is to empty the radiator each time that it freezes or threatens to freeze, provided that there is no doubt about it.

It has been suggested that the freezing point should be lowered by mixing the radiator water with chemicals like glycerin, methyl alcohol and calcium chloride. Glycerin has the disadvantage of fouling the radiator tubes and pump, and diminishing the cooling power of the radiator. Methyl alcohol gradually evaporates, as it boils at 80° C. Calcium chloride which gives the best results, used at the rate of 220 gm. per litre of water, lowers the freezing point to -10° C.

The engineer M. F. CESBRON, of 37, rue de Brissac, Angers (Maine-et-Loire), has invented an apparatus called the *Frigon* (see figure), which



Apparatus for protecting a tractor radiator against freezing.

automatically empties the radiator before the water freezes. The apparatus, which is quite small (14.5 × 10.4 cm.), communicates with the radiator at its lowest point by the junction 13, which opens into a chamber 1, closed at its lower end by valve 2, kept tight on its seating by a spring pulling on the lever 3.

The apparatus includes a copper coil 6, with an internal diameter of 4 mm. ; the lower end of the coil is closed by a piston whose shoulder rests on the lever 3.

To put the machine ready for action, the stopper 7 is screwed up until the water begins to drip from the end of the coil. This shows that

the coil, which is filled through a feed communicating with the chamber 1, is full of water and that the apparatus is ready.

As the temperature of the air falls, the water in the coil, on account of its small volume (5 cc.) and the great conductivity of the copper wall, cools more rapidly than the radiator, so that the water in the coil is frozen while that in the radiator is still liquid. The increase in volume due to the water freezing in the coil pushes the piston which, acting on the lever 3, opens the valve 2 and thus empties the radiator.

Experiments carried out by M. RINGELMANN at the "Station d'Essais de Machines" have shown that the apparatus works when the radiator water is still at 3° C. The water freezing in the coil moves the piston a distance of from 2-4 mm. The apparatus, placed on the radiator of a 17 H. P. MORS automobile, emptied all the water that could be emptied by the waste tap before it was frozen.

To provide for the safety of pumps, tanks, etc. that might be injured by freezing, this apparatus, which when placed in position requires no further attention, could be used.

455 – **Ploughs for Mechanical Cultivation.** — DUVAL, G., in *La Vie Agricole et Rurale*, Year IX, No. 45, pp. 331-334 + 5 Fig. Paris, November 8, 1919.

AUTOMATIC LIFT AND EARTHING. — Mechanical cultivation, which enables and even requires the use of gang ploughs, has given the maker the problem of lifting and earthing the ploughs automatically. Some strong, simple mechanism was required, as well as a movement that requires no effort or attention on the part of the driver, who is already sufficiently occupied with driving and has, in addition, just at the moment when he should set the mechanism in motion, to turn correctly and come accurately back to the furrow.

The "Motoculture Week" at Senlis provided the chance for the study of a large number of ploughs with automatic lifts; the system on which they work is described succintly below:

AMERICAN PLOUGHS FOR PLOUGHING IN RIDGES. — The American solution can be summarised as follows:

The frame *B* (Fig. 1), to which the gang is fixed, is supported in front by wheels, at least one of which plays a part in the operation. The wheel *R* is mounted loose on the axle *E* on a hub *C* of large diameter. A drum *T* is keyed on the axle inside the hub *C*; it is provided with a button *a* to which one of the ends of the rod *b* is attached, the other end being attached to a certain point of the frame *B*.

If the frame *B* is in the low position and if it be supposed for the moment that the drum *T* is momentarily fastened to the ring *C*, when the wheel *R* turns the connecting rod *b*, the frame *B* will be brought to the position *b'* and *B'*, and the plough will be lifted. The mechanism should hold the frame in this position until a second movement allows it to fall or even mechanically brings it to the low position. Usually, a simple transmission acts on the wheeled back of the plough so as to change the level at which it runs compared with the frame, either by making the stay pivot round

a horizontal articulation or by making the stay slip on its support. The plough is lifted by placing the stay in a vertical position and moving the guide downwards; the reverse movement earths the plough. As the plough is fairly heavy, lifting is helped by the provision of springs which tighten as the plough earths and takes up part of the weight when the plough is lifted.

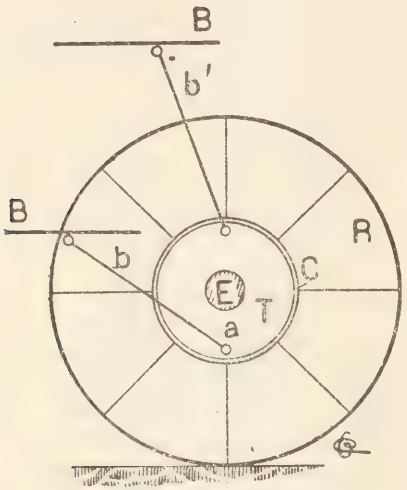


Fig. 1. — Scheme of the American plough.

The lift system on the OLIVER plough (Fig. 2) is made up as follows :

1) of a roller *G*, fixed on the frame *B* ;

2) of a cam *C*, of special shape, with a catch *V* pulled by spring towards the axle *E*, and provided with a circular notch *e* ;

3) of two rollers *g'* and *g* mounted on the jointed levers *a* and *c*, connected by the rod *b* ; a spring *R* tends to pull *g* towards the cam *C* ; they are separated by a lever *A*, through a small rod *d*, when a cord is pulled in the direction shown by the arrow.

4) of a rachet wheel *R*, fastened on the axle *E* of the front wheel.

When the apparatus is in the low position, the roller *g* is in the notch and presses on the end of the catch which then becomes disengaged from the rachet wheel. Everything is now free as far as the wheel is concerned. To lift the frame, the driver pulls the lever in the direction *f* ; the roller *g* is moved away from the cam, and the catch is pulled down by the spring *r*. The cam *C* turns and lifts the roller *G*, which moves to the position *G'*, carrying the frame with it, thus lifting the gang. A connecting rod transmits this movement to the rear wheel.

When the high position is reached, the roller *g'* enters the notch, pushes on the end of the catch *v* which is disengaged from the rachet wheel when the

disconnection is carried out. The roller g', held in the circular notch e by the spring R', forms a stop. On moving the lever A again, b is freed and the gang falls by its own weight, the roller g returns to its place in the notch and frees the bolt v ; the machine is now in the low position. This mechanism is simple and strong, and easily accessible, being uncovered. There is a slight disadvantage as the parts are not very near to the soil.

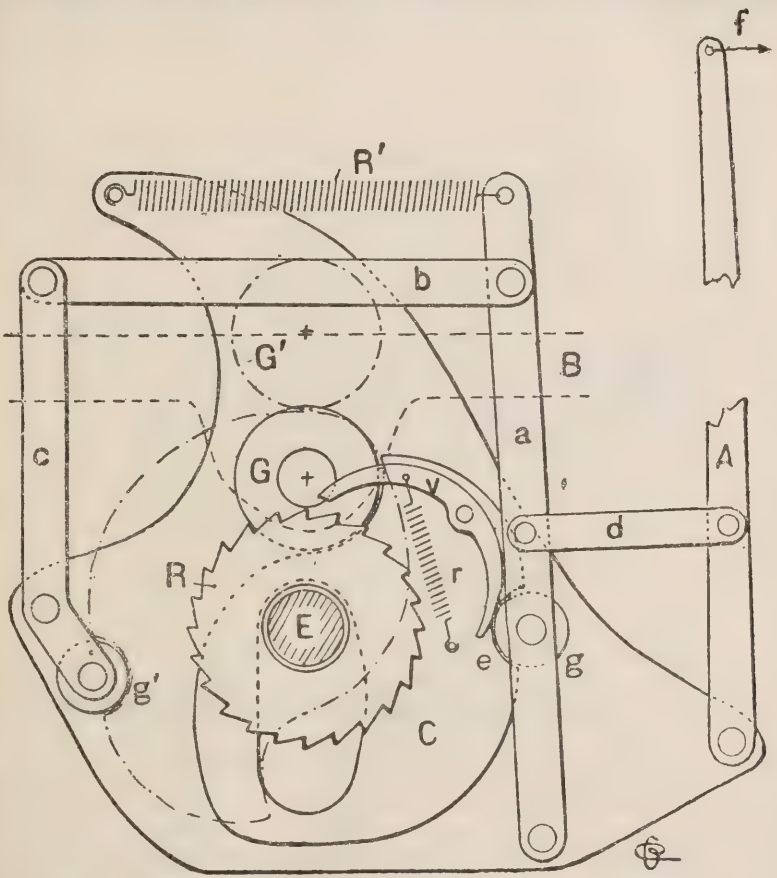


Fig. 2. — Mechanism of the OLIVER plough.

In the two-furrow, No. 7 OLIVER plough, lifting is carried out by an excentric toothed segment fixed on the frame. When the lever is moved, the segment meshes with the lantern-wheel fixed on the turf wheel. With a forward movement, the whole rotates round the cranked shaft that connects the frame and the wheels.

In the JOHN DEERE ploughs, the self-lift mechanism is of the same type as that shown in Figure 1. The frame B (Fig. 3) is attached to the wheel

R by the cranked shaft *EEb'*. The lever *a* on the drum *T* moves the rod *b* which presses, not on the frame *B*, but on the depth-regulating lever j, which is fastened to the frame by a bolt engaged in the appropriate notch of the sector *s*. When the lever *L* is pulled by the cord *x*, the roller *G* frees the catches *c'* and *c*, which jams the drum *T* to the ring *C* and thus with the wheel *R*, the frame passes from the low position *B* to the high position *B'* ; the rear is also moved by the pivotal motion of the " heel ".

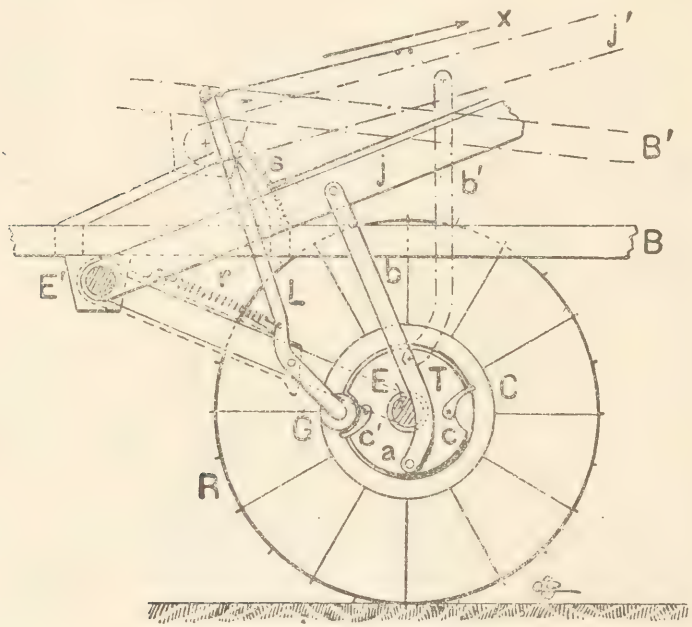


Fig. 3. — Mechanism of the JOHN DEERE plough.

Figure 4 shows the construction of the JOHN DEERE pawl and ratchet device. To avoid confusion, the ring *C*, which forms part of the wheel ; is shown in dots, the mechanism, of the drum *T* being shown in black lines. The ring *C* is provided internally with a series of circular notches that make it a sort of ratchet. At the right moment, a roller *g*, mounted on the rod *k* which commands the spring *r*, will slip into one of these notches; the articulation of *k* carries a pawl *c'*, keyed on the axle and when the pawl moves, it also moves *k* and *g*. A second rod *d*, with a pawl *c*, is keyed on the opposite side of the axle *E* ; *d* and *k* are joined by a small rod *h*. The drum *T* has two notches at the level of the catches *c* and *c'*. In the figure, the roller *G* is in the right hand notch, pulled by the spring *r* shown in Figure 3. It

pushes back the pawl *c* and *g* does not mesh with the ring *C*. If *L* is pushed, *G* moves away, frees *c*, and the spring *r* pushes the roller *g* in a notch of *C*; the device has operated and the crank has moved the lifting rod.

After 180 degrees are rotated, *G* moves into the second notch, pushes back the pawl *c'*, and frees the roller *g* of the ring and disengages the drum *x*, while holding up the plough until a fresh pull on L, brings about meshing again, when the frame comes down to the low position after a rotation of 180 degrees, when the roller *G*, acting on *c*, again frees the drum, and so on.

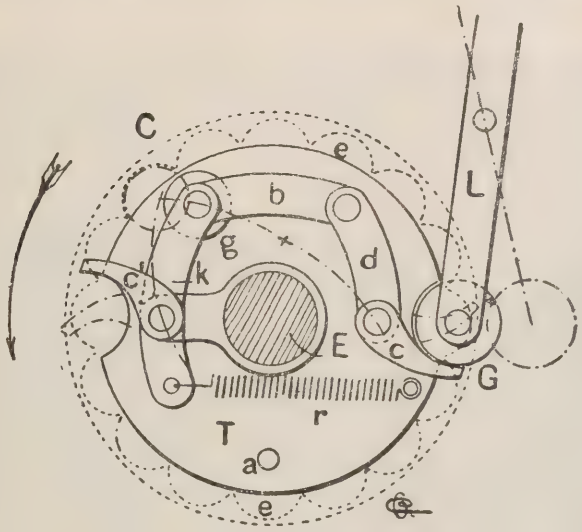


Fig. 4. — The John Deere click work.

Chain Mechanisms. — On the P. O. (Wallut), Grand Détour, Case and other ploughs, the self-lift operates by pushing forward the elbowed axle that joins the wheels and frame. To do this, a toothed pinion is mounted on the central part of the axle with which it is connected by a pawl and ratchet similar to that just described. This pinion turns continually, being driven through a chain by another, but smaller pinion mounted on the hub of the wheel.

When the rachet mechanism is put into action, the central part of the elbowed axle turns and pulls the wheels towards the gang, but as the resistance of the soil stops this, the inverse movement is produced, the central part of the axle-turning round the spindle of the wheel and, moving forward, lifting up the frame.

American Ploughs for Ploughing without Ridges. — At Senlis, the only ploughs of this type were two-wheeled ploughs with two independent bodies, one on the left and one on the right.

In the Moline Sulky plough, the end of the beams is kept at a fixed level, but, a little to the rear, is a bent shaft, which lifts or earths the ploughs.

The driver presses a pedal which acts on a friction cone in a drum mounted on the hub of the wheel, thus forcing it to turn with the wheel ; the drum bears a circular groove on which rolls a chain which, pulled in this way, turns the bent shaft. A similar arrangement is used in the horse sulky and enables it to be driven by a man with a disabled arm.

French Ploughs — Although the problem was considered much later in France than in America, some elegant solutions have been found. The number of the *Vie agricole et rurale* from which this article is abstracted, contains a description, by M. Coupan, of the self-lift devices of M. M. Dubois and Lefèbre.

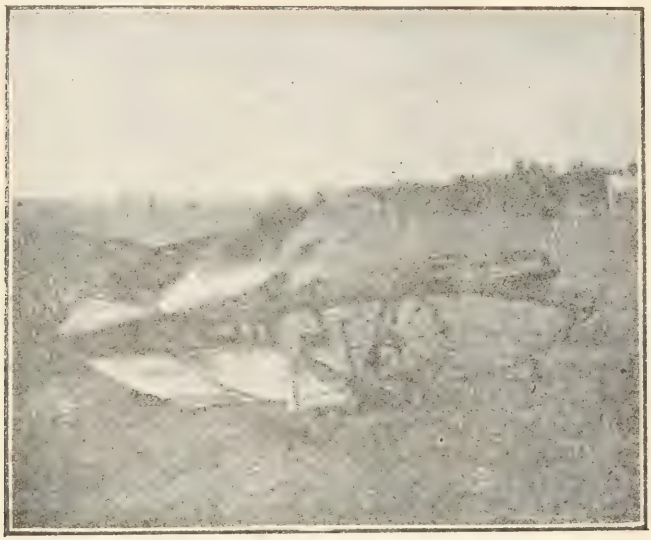


Fig. 5. — Piltz-Grivolas double brabant plough.

The "Etablissements Bajac" showed a turn-wrest plough with a special anti-balance device. This plough, which works with a motor windlass of the same firm, is characterised by a bearing axle capable of a large angular displacement around an axis transversal to the frame. This axle carries with it a toothed ring which gears with a second ring with internal teeth and fastened to the frame that supports the ploughs. Thus, when the axle moves in one direction, the frame is moved in the opposite direction. This device shifts the centre of gravity of the frame from the normal and gives great stability. When speed is changed, it makes earthing easier for in many cases only the tipping occurs.

The "Messidor" plough of the Etablissements Pétard, is a sort of Belgian gang plough that can be attached to any tractor. But the stays, instead of being in the same plane, are in two planes at 90° to each other, so that the gang can be changed by a rotation of a quarter of a circle. This is

done through a circular rack driven by a pinion worked by hand. In the rear this plough has a sort of rolling heel with two equal wheels running obliquely, one in the furrow and one on the turf but without a pawl and ratchet mechanism; the heel enables the machine to run backwards.

The new double brabant two-furrow plough of the *Société matérial de culture moderne* (Etablissements FILTZ-GRIVOLAS) has a massive " ecamoussure " (70 kg. for a total weight of 420 kg.) behind which is the two-wheeled axle. It will be seen from Figure 5 that this support is derived from the self-lift lever, but the two arms are continued by a part bent in front which moves in front of the sectors ; the ends are joined by two strong springs in front of the " ecamoussure ".

The drawing action affects the axle, which moves forward, tightening the springs more as the pull becomes greater ; tappets in suitable positions on the sectors limit the displacement and regulate the entrance. This plough enters the soil gradually, not suddenly. When the tractor stops at the end of the furrow, the springs pull the axle back, which lifts the beam, starts the lift and prepares the machine for turning. As the " ecamoussure " is carried far forward, the plough can be lifted and turned easily by a labourer of medium strength.

Two ploughs of this type were ploughing without ridges at Senlis, hauled by FILTZ tractors, one with a cable and the other with direct traction, a system of attachment being used that obviated turning. This device would be useful on horse brabant ploughs.

456 – **Damage of Seeds in Threshing.** — MARTINET G., in *La Terre Vaudoise*, Year XII, No. 10, pp. 78-79 + 1 Fig. Lausanne, March 6, 1920.

According as the season is more or less dry, the proportion of grains of wheat that are broken or simply cracked by the thresher is fairly large and not only leads to wastage but to deficient germination and plants that come up too thinly. The splitting of the grain is only detected when it is treated with copper sulphate, as the fissure stains blue. Split grains are obviously not sieved out in the machine and the large grains are the most likely ones to suffer.

When cereals were threshed with a flail, the cut wheat was left to ripen and dry in the field particularly oats, which were often left 2 or 3 weeks, the reason being to facilitate separation of the seed. The need for reducing the cost of harvesting has led to the neglect of this practice and the crop is too often brought in too early, before the straw is sufficiently dry, especially at the nodes. The remaining damp causes the heap to ferment too much and as well as spoiling the seed, not only in the case of oats, but also with naked seeds.

As the crop is not sufficiently dried, the action of the organs of the threshing machine has had to become more vigorous in order to separate the seed completely. Consequently, the drum has to revolve more quickly and the fittings of the drum and counter-drum are closer set. The beaters themselves, which were formerly wooden staves cased with iron or angle irons whose ridge was the sole active part, have given place in the modern

drums to beaters with oblique, very prominent grooves, so that the thresher would be almost like a crusher, did not the presence of the straw somewhat mitigate the violent action of the shelling organs on the grain.

The " English " beaters are suitable for wheat with soft seeds, but not hard or semi-hard seeds. In fact, some recent threshers of English make have beaters with less pronounced undulations and with the front part bevelled, and, in addition, the beater is often preceded by a plane, inclined portion which pulls the straw and ears less roughly towards the beater, the material being treated less roughly. In this respect, the angle iron and to a certain extent, the closed drum, act more or less in the same way.

The French makers fit the working part of the beaters in their machines with iron bands with fairly smooth longitudinal undulations, so that breakage is diminished or hardly occurs.

The makers, therefore, should study the subject, so as to avoid useless damage to the grain and straw. The author thinks that the French beater with an inclined plane is the type that should be adopted.

In threshing seed grain, it might be useful to adopt a light pre-thresher, with soft wooden beaters, which would separate the large grains for use as seed and would be followed by complete threshing with the ordinary drum placed immediately afterwards.

457 – **Review of Patents.** — *Sources*: CANADA, UNITED STATES, FRANCE, NEW ZEALAND, UNITED KINGDOM, SWITZERLAND, see *R.* January, 1920.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada:* 193896 Combined plough and cultivator; 193980-194429-194835-194984-194999 Cultivators; 194282-194665-195191 Tillage machines; 194939 Turn-wrest plough; 195007 Tractor plough; 195120 Stone gatherer; 195228 Traction mechanism for ploughs; 195324 Plough frame; 195470 Machine for destroying stubble.

France: 497459. Motor vehicle for mechanical cultivation; 498348 Pulveriser attachment or ploughs; 498701 Motorplough.

New Zealand: 40943 Plough; 40911 Extirpator; 41011-41148 Cultivators with rotary pieces; 42071 Depth regulator for ploughs; 42229 Working part for a scarifier.

Switzerland: 84387 Harrow; 84388 Turn-wrest plough; 84391 Hoes for tillage machines; 84396 Combined hoe and tillage machine.

United Kingdom: 134288-134561. Motorploughs; 134293 Plough mould board.

United States: 1321248 Pulveriser; 1321367 Guide and depth regulator for ploughs; 1321551 Tractor plough; 1322066 Swingle-trees for disc-harrow; 1322455 Cultivator; 1323082-1323184-1324719 Garden ploughs; 1323481 Harrow suspended from a cart; 1323887 Disc-plough with sub-soiler.

MANURES AND MANURING. — *Canada:* 194796-195602 Process for making aluminium nitride.

New Zealand: 41071-41072-41073. Processes for manufacturing nitrates; 41074 Process for manufacturing calcium nitrate.

United States: 1322031-1324540 Manure spreaders: 1323674 Manure loader.

DRILLS AND SEEDING MACHINES. — *Canada :* 194569 Maize sower.
Switzerland : 84192 Potato planter.
United States : 1321226-1322574-1322915 Potato planters ; 1322709 Machine for cutting seed potatoes ; 1324045 Maize and pea sower ; 1324618 Machine for replanting ; 1324728 Accessory for sower.

VARIOUS CULTURAL OPERATIONS. — *Canada :* 195151 Maize cultivator.
New Zealand : 40911 Weed extirpator.
Switzerland : 84394 Swede hoe ; 84396 Combined hoe and tillage machine.
United States : 1321152 Straw spreader ; 1324187 Cultivator for mangolds, etc.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Canada :* 194708 Machine for destroying potato bugs ; 194868 Couch-grass destroyer.
France ; 497314 Machine for barking and lime-washing vines and fruit trees.
New Zealand :— 40911 Weed extirpator.
United States :— 1322133 Cotton chopper ; 1322742 Weed extirpator ; 1323016 Machine for destroying the cotton boll weevil (*Anthonomus grandis*).

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada :* — 194807 Hay rake ; 195173 Bean, etc., harvester ; 195218 Machine for supporting hay to be tedded ; 195281-195573 Shocking machines.
Switzerland : — 84193 Device for protecting the mower knife-bar ; 84194 Machine for compressing and tying sheaves.
United Kingdom : — 134442 Mower.
United States : — 1321805 Sorghum header ; 1321977 Machine for treating binder thread ; 1323388 Mower ; 1323404 Tobacco harvester ; 1324031 Shocking machine ; 1324683 Maize harvester.

MACHINE FOR LIFTING ROOT CROPS. — *Canada :* — 194751 Potato lifter ; 195475 Potato gatherer.
United States :— 1321326 Groundnut harvester.

THRESHING MACHINES. — *Canada :* — 194263 Threshing machine ; 194900-195000-195104 Sorters.
United States :— 1321263-1321510-132877 Sorters ; 1321979 Combined harvester and thresher ; 1322303 Maize thresher ; 1323691 Seed-cleaning machine ; 1323784 Seed cleaner and sorter ; 1323906 Paddy thresher.

TRANSPORT. STORAGE AND PREPARATION OF CROPS. — *Canada.* — 193935 Hay press ; 194318 Fruit sorter ; 195261 Silo door ; 195452 Sectional silo.
Switzerland : — 84195 Process and machine for drying damp crops, especially maize cobs.
United States :— 1321263 Hay press ; 1321851 Potato sorter ; 1321991 Hay stacker for barns ; 1322256 Device for drying hay.

FORESTRY. — *Canada :* — 195098 Stump destroyer.
France : — 498202 Machine for felling coppice wood.
Switzerland :— 84395 Machine for tying wood in bundles.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada :* — 194784 Attachment between a tractor and an agricultural machine ; 194869 Tractor draw-bar and hook ; 195009 Garden tractor ; 195228 Traction mechanism for ploughs.

France :— 498185 Machine for propelling and drawing agricultural machines.

New Zealand :— 40807 Farm tractor.

Switzerland :— 84389 Device for converting an automobile into a tractor ; 84390 Bearing wheel for tillage machines.

United States : — 1321415 Wind engine.

FEEDING OF LIVESTOCK. — *Switzerland :*— 84006 Root chopper ; 84393 Root and tuber cutter.

United States :— 1324147 Straw chopper.

POULTRY FARMING. — *Canada :*— 194184 Machine for applying insecticides to poultry.

United Kingdom :— 134492 Poultry food.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Switzerland :*— 84196 Steam drier for fruit, etc.

DAIRYING. — *Canada :*— 193903 Milking machine ; 193904-193905-193956-194127 Milking-machine teat cups ; 195589 Churn.

New Zealand :— 42068 Milking machine.

United States :— 1321372-1322588-1322589 Milking machine pulsators.

VARIOUS. — *New Zealand :*— 41649 Wire fence with reinforced concrete posts ; 42302 Device for preventing stock from breaking metal fences.

United States : — 1322024 Apparatus for heating the water in a tank ; 1323771 Wire stretcher.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

458 – **Competition for Wines from Direct Bearers.** — DEGRULLY, L., in *Le Progrès agricole et viticole*, Year XXXVII, No. 6, p. 131. Montpellier, February 8, 1920.

Although the vineyards in the south of France were almost free from mildew during the summers of 1918 and 1919, thanks to the persistent drought, many vine-growers continue to turn to direct bearers as they know that these favourable conditions are only temporary and may be followed by less kindly years, so that they consider the *partial* adoption of direct bearers as a sort of insurance against bad luck. It was on account of this, that the " Société centrale d'Agriculture " of Gard organised, at the end of January, 1920, a competition for wines produced by direct bearers in that department.

The tasting jury, with M. TOUCHARD VERDIER presiding, collected its remarks in a report from which the author has taken the following notes : —

157 Gaillard-Girerd, good wine with a rather special taste.

Baco 22 A, good wine slightly foxy ; the same, gathered in 1918, was much improved.

880 Seibel, foxy.

2007, a good wine, a little foxy.
128, good blending wine, highly coloured.
1025, ordinary wine, passable.
1000, mediocre, not worth encouraging.
2006, very good, slightly foxy.
1028, very ordinary.
Couderc, 7120, good average wine.

Tasting competitions like this are very useful in enabling the interested persons to form an opinion of a variety before committing themselves to large plantations and thus risking a loss.

459 – **Role of Bean Flower in Bread-Making.** — KAYSER, ED., and ARPIN, in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 7, pp. 144-150. Paris, February 18, 1920.

It has been long known that bakers, in order to improve the quality of their dough, like to mix the flour with bean flour, in a proportion that never exceeds 4 % ; though without knowing the scientific explanation of this old custom.

M. FLEURENT, who found in 1899 that the gluten in a flour should contain 1/4 of gluten and 3/4 of gliadin in order to make the best bread, has shown that bean flour contains, on the contrary, a large excess of glutenin, which again balances the two constituents of the gluten, when they are not present in the right proportions.

The authors have attempted to find out why bean flour has this good influence in bread-making. They found that as sucrose and the proteolytic diastases were not very abundant in bean flour, the improving effect of bean flour on wheat flour could be probably explained as follows : —

1) Bean flour contains a considerable proportion of amylase, as the authors found by its action on macerated malt.

2) Thanks to its content of soluble nitrogenous matter, it assists alcoholic fermentation, increases the proportion of sugar transformed, the weight of yeast and the quantity of carbonic acid given off ; in this connection, the strain of the yeast seems to be as important as the origin and composition of the bean and wheat flours (which varies with the rate of bolting) used.

3) It helps lactic fermentation, the lactic ferments produce a certain quantity of carbonic acid and, at the same time, lactic acid which, in moderates amount, assists the transformation of the assimilable nitrogenous matter and protects the mass against butyric fermentation.

4) The principles contained in bean flour may possibly have a stimulating effect on the secretion of the alcoholic zymase by the yeast for not only does adding them cause the fermentation to start more rapidly, but adding them plus a few decigrams of wine yeast, in the presence of 40-45 % of sugar, gives rise to a quicker evolution of gas as well as a thicker froth than that observed in a tube to which no bean flour had been added, which shows a very active zymase.

5) As M. FLEURENT ahs shown, glutenin corrects the excess of gliadin in wheat flour; the addition of bean flour, which brings in glutenin, is

all the more necessary in making bread from flour poor in glutenin seeing that a part of this, according to KOSUTANY, is changed to gliadin and that it is essential to maintain a suitable proportion between these two elements.

This work also shows that as baking flour varies in composition, bean flour should be used judiciously and only added to wheat flour in a suitable proportion. Again, as the composition of bean flour is variable, their qualities should be determined by analysis.

460 – **Manufacture of Vegetable Oils in Japan.** — *Bulletin des Matières Grasses de l'Institut Colonial de Marseilles*, 1919, No. 5, p. 216. Paris, 1919.

The oil works in Kobe and district that treat copra and soya have done remarkably well owing to the greatly increased demand for vegetable oils in the United States during 1917 and 1918. The total Japanese production of oil is 223 500 cases (7804 metric tons) a month, consisting of :— Soya, 92 500 cases; coconut, 68 000; rape, 44 000; cotton, 16 000; groundnut, 3 000 cases. In the consular district of Kobe there are 25 large vegetable oil-mills which produce roughly 75 % of the whole Japanese output. All except 3 press out the oil, the remaining 3 use benzine for extraction purposes. Three types of mill are in general use : — 1) the round type with a base about 46 cm. across, used for soya and rape; 2) the type with an oblong, flat base, measuring some 75 × 35 cm., used for copra; 3) the bowl type, in which a stone roller crushes a certain amount of seed pulp kept in by iron circles, used to crush soya and groundnuts a second and third time.

The Kashiwara oil works employs the latest American system of rotating screw press. When filtering is required, ordinary filter presses with fullers' earth are employed. A new mill with a capacity of about 20 000 cases a month is being built, and many local mills are being enlarged so as to increase their output or to enable them to treat other seeds. The plant installed is usually an adaption of American or Japanese machines for treating cotton seed.

461 – **Studies on the Rustiness of Sheet Rubber.** — HELLENDOORN, H. J., in the *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year III, No. 9, pp. 419-436. Batavia, October, 1919.

The rustiness of sheet rubber (1) has been attributed to various causes it has been ascribed to the formation of a superficial layer of resin ; MORGAN suggested that it was due to incomplete coagulation of the latex and EATON

(1) Sheet rubber is prepared as follows : — The latex is coagulated in enamelled dishes like those used in photography; the coagulum is taken out and squeezed with a wooden roller on a wooden table to remove the water; the sheet thus obtained is rolled between rollers with different patterns on their surface and turning at the same speed (in making crepe rubber, they are closer together and run at different speeds) the distance between the rollers is decreased each time the sheet is passed through, so that the sheet becomes thinner and marked with regular figures : in this way the diamond sheets are obtained; they are then dried and smoked (crepe is not smoked). (*Ed.*)

thinks that it is a deposit of certain constituents of the serum, especial proteins, dried in a film on the surface of the rubber.

The author's researches have led him to the conclusion that rustiness is due to the decomposition of the serum, especially of the protein matter, by an aerobic micro-organism. The results of the experiments are given below :—

1) *Experimental production of rustiness.* — The author was always able to produce rust experimentally on sheets just taken from the roller and kept in a damp atmosphere for 24 or 48 hours. These sheets were hung up in petrol tins containing a layer of water on the bottom and tightly closed ; small pieces of rubber placed in a glass containing water on the bottom also became rusty.

The great importance of the dampness of the atmosphere in which the sheet is placed after rolling is shown by the fact that sheets placed in a dry room at 40-60° C. immediately after rolling never became rusty, while, at the ordinary temperature, rust occasionally appeared during damp weather. When the petrol tin mentioned above was not hermetically closed, the parts of the sheets turned towards the top and near the cover where there was some ventilation were sometimes free from rust, whereas the lower parts and those near the water in the bottom were always rusted.

2) *Rust occurs if the coagulum is only rolled into sheets some time after coagulation.* — Arens has stated that when the coagulum is left in the coagulation dishes for some time after it is done (a night, for example), the part of the sheet corresponding to the upper side of the coagulum and which has, consequently, been exposed to the air, is more rusty than the part of the sheet corresponding to the lower part of the coagulum that was immersed in the serum. This is due to the fact that infection and, possibly, the development of the aerobic organism, can take place more quickly on the surface. The author found that the rust increased if the sheets were rolled 24 hours after coagulation instead of immediately after.

It should be noted that the atmospheric conditions in which the sheet is placed are very important, as pointed out previously, and they may act in both ways on the effect of the infection on the coagulum. Thus, it may happen that the lower side of the sheet in the tin is more rusty than the other side on account of the greater humidity to which it is exposed, even if it was the side that was immersed in the serum during coagulation. In present practice, as the coagulum is rolled immediately after coagulation, rust can only appear on those parts of the sheets that remain damp during the period just after rolling.

3) *Disinfection.* — Rust can be avoided by disinfecting the surface of the sheets as they come from the rollers, e. g., by immersing them for a certain time in dilute solutions of formalin, chinosol (ortho-hydroxyquinoline sulphate), or bisulphite. Even when a large proportion of the untreated sheets is rusty, the disinfected sheets do not show a trace of it, or if the disinfection is not sufficient, they only show traces.

If feebly disinfected sheets are kept for a long time in a damp atmosphere, rust will always appear, but if the sheets are disinfected by placing

in a tin containing dilute formalin instead of water, rust formation is prevented. The same disinfecting effect can be obtained by submitting the freshly rolled sheets to the action of steam or dipping them in hot water. This is the well-known method much used of late years to avoid rusting and surface oxidation due to enzymes. The author found a very slight rustiness on sheets that had been immersed for 10 minutes in water at 35-50° C., and disinfection was complete when the water was at least at 60° C.

4) *Rust caused by an infection.* — The author died before he was able to isolate the micro-organism of the infection, but his experiments demonstrated its existence. If rust from infected sheets is suspended in water, and this water is sprinkled on sheets that have been disinfected by steam, the latter sheets will rust. Similarly very dry sheets infected by a drop of the suspension and placed in a damp atmosphere for some time also becomes rusty.

5) *The micro-organism is aerobic* — Like practical experience, the author's experiments show that air is absolutely necessary for the development of rust on the sheets. Thus if a newly made sheet is rolled up tightly, only the outer part in contact with the air will rust if it is placed in a damp atmosphere. Again, if sheets hung up side by side become rusty, it has been demonstrated by practical experience that sheets that are touching remain free from rust. The author has shown by special experiments that rust does not grow in an atmosphere deprived of oxygen.

6) *Effect of temperature.* — The optimum temperature for the organism seems to be about 40° C. When the tins or glasses that constituted the damp atmosphere were placed in an incubator at 40°, rust developed with greater intensity than at the room temperature (27° C.); but at 50° C. no rust appeared. This temperature is perhaps too great for the growth of the micro-organism, but it may be that at 50° C. the humidity of the surrounding air is too low, so that the organism cannot obtain sufficient moisture.

7) *Source of food material.* — The thin layer of serum material that remains on the sheet after draining, or the substances absorbed by the rubber, constitute the sources of the food material for the micro-organisms. In this respect, diluted serum seems preferable to non-diluted serum; sheets made from dilute latex (15 % and even 5.7 % of rubber) were more rusted than sheets from an undiluted latex. If a large part of the soluble matter of the serum is left on the sheets when washing them in water after rolling, rusting is not avoided, but, on the contrary, is much more prevalent.

Planters are well aware that if very dilute serum is left on the sheets after washing them in water, there forms a layer with a gelatinous consistency just as if fat had been extracted from the rubber. This substance is probably closely connected with the matter that forms the film of rust. The work, however, was interrupted before this film could be chemically examined.

8) *Disinfection by smoke.* — The question as to whether smoke is a disinfectant that suffices to prevent the growth of the micro-organisms is of great practical importance. If damp sheets are placed in smoking rooms with poor ventilation, a damp atmosphere may be formed with a slightly raised temperature, thus constituting very favourable conditions for the development of the micro-organisms, unless the smoke is a sufficient protection. The author's experiments seem to show that smoke prevents a considerable formation of rust under these conditions, but does not prevent it completely. Rust may develop especially in those places that are not easily penetrated by the smoke, as for example in those parts where the sheets are very close together. But if the sheets are rapidly dried in the air and if they are sufficiently dry when placed in the smoking rooms, smoking is not of great importance in this respect, as the sheets are already under conditions that do not favour the growth of the micro-organism.

9) *Practical method for preventing rust.* — The simplest method for preventing rust under present conditions is to dry the surface of the sheets sufficiently quickly so that the micro-organisms have not time to develop, as they only grow on the surface exposed to the air and require moisture. After rolling the sheets and washing them in water, they should be hung up in such a way, as to be well separated one from another in a well-ventilated place, outside the factory, if required, under a shelter or in a shaded spot, which is preferable to some dark corner of the factory. After drying for a few hours only, they should be put in the smoking room. The sheets should not be left to drain outside the smoking room during a night.

Rust can also be prevented by disinfecting the surface of the sheet with a dilute solution of formol or chinosol, but this method is not to be recommended, as it is less efficacious and costs more than the practical method described previously.

The method which consists in plunging the sheets for a certain time into warm water should be discarded, as the quality of the rubber might suffer.

462 – **Utilisation of Frosted Sugar Cane as Fuel, and its Calorific Value.** — Padros, J. S., in the *Universidad de Tucumán, Informes del Departamento de Investigaciones industriales*, No. 7, pp. 33-43. Buenos Ayres, 1918. — Diaz, C. *Ibid.*, p. 44.

In June and July, 1918, there were sharp frosts in the Tucumán region of Argentina, which rendered large quantities of sugar cane of no use for sugar manufacture. As the question of utilising them came up, Prof. Padras suggested their use as fuel, as 3750 kg. of cane with 70 % of moisture is equal in calorific value to 1000 kg. of fire-wood.

Señor Diaz has studied the fuel value of frosted canes belonging to some of the varieties grown at Tucumán ; he obtained the following results, calculated on the basis of the dry matter.

Fuel value of certain varieties of sugar cane.

	Java cane 234	Java cane 213	Java cane 228	Java cane 36	Cane charcoal *
Ean.	64.75 %	58.67 %	61.00 %	55.00 %	3.5 %
Combustible matter	35.35 %	41.33 %	39.00 %	45.00 %	96.5 %
Fuel value	4140 cal.	4075 cal.	4017 cal.	4009 cal.	6661 cal.

* Incompletely carbonised, containing some 20 % of volatile matter.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

463 – **Butterfat Losses in Creameries.** — WASHBURN, R. M., DAHLBERG, A. C., SORENSON J. and MORTENSEN, M. P., in *The University of Minnesota, Agricultural Experiment Station Bulletin* 177, pp. 12. University Farm, St. Paul, September, 1918.

The authors have investigated the differences between the actual and calculated yield due to mechanical loss of fat as well as to losses due to inherent defects of the Babcock test (1), or to faulty manipulation of that test under commercial conditions. The observations were spread over 43 working days at the Minnesota State Creamery.

A preliminary series of studies convinced the authors that the Babcock test for milk and cream, carried out without special precautions, is sufficiently accurate for the purpose. But the method laid down for carrying out this test should be strictly adhered to. Faults committed in the composition of the cream samples, even if they are fresh and not thick, are a source of considerably greater errors than the comparatively unimportant ones due to the Babcock test.

An attempt was made to determine accurately the loss of fat at all the stages of manufacture under ordinary conditions. The weighing vessels, the milk cans, the pasteurisers, the pipettes, pumps, etc., after the usual rinsing, were carefully washed out with boiling water, the water then being weighed and sampled quickly. The water used for washing the butter and the boiling water used for washing the churn were both weighed in the churn and sampled when they were done with. All the washing waters were examined by the Babcock method (bottles of skim milk). The skim milk and the buttermilk were examined by means of the gravimetric method and the Babcock test. Samples of buter were taken at 10 different points of the churn at least and examined gravimetrically. Details of the mechanical losses are given in the appended table see page 513.

The mechanical loss is practically independent of the volume treated, so that the percentage loss in a large creamery is very small, but careless work will considerably increase it.

See *R.* March, 1920, N. 362, (*td*).

The chief cause of the loss of butter fat that could not be specified, was due to the fact that the Babcock method shows only about one-third

Losses of fat in the mechanical method of butter-making.

Causes of loss	Daily losses of fat at the experimental creamery	
	lb.	*Babcock test*
Weighing vessel, vat, heater	0.38	0,13 %
Cream pre-heater, pasteuriser, refrigerator	1.55	0,23
Vessel for ripening the cream	0.15	0,07
Washing water of the butter	0.14	0,03
Washing water of the churn	0.61	0,14
Total losses in a creamery treating whole milk		1,38
Total losses in a creamery treating cream separated by a hand machine		0,76

of the fat really present in the skim milk and buttermilk, as is shown by the following figures : —

	Babcock method	Gravimetric method
Fat lost in skim milk	0,49 %	1,64 %
Fat lost in buttermilk	0,29	0,9
Fat lost mechanically	0,60	0,60
Fat recovered in the butter	96,72	96,72
Losses that could not be specified	1,90	0,11

The percentage losses of the skim milk and buttermilk are not influenced by the quantity of butter produced each day. In a creamery where whole milk is used, the losses from all causes are 3.17 %, and in a creamery which receives and works cream separated by hand separators, they are 1.4 %, after deducting losses in the skim milk, in the weighing vessel and heater.

The drip method of sampling, which consists in taking samples from a tap in the pipe leading from the heater to the separator, is sufficiently accurate to allow the daily, production to be examined without it being necessary to analyse each day the milk supplied by each client ; the average error of 43 samples taken in this way was 0.39 %.

464 – **Transport of Milk in Frozen Blocks.** — *Le Froid*, Year VII, Vol. VII, No. 12 p. 322. Paris, December, 1919.

The best method for transporting milk for long distances is as follows :— Freeze ⅓ of the volume of the milk in blocks weighing from 10 to

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25 kg. ; place one of these blocks in each milk can, then fill with pasteurised milk cooled at 4° C. Milk treated in this way can be kept safely for 2 or 3 weeks and be transported to any distance.

It should not be forgotten however, that while cold reduces the growing power of microbes, it dœs not completely destroy their faculty of secreting specific enzymes, and this, from the hygienic point of view, cold can only be counted upon for preserving sound milk.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

RESISTANT PLANTS.

465 – **Varieties of Potato Resistant to Wart Disease (*Chrysophlyctis endobiotica*) in England.** — See No. 420 of this *Review*.

MEANS OF PREVENTION AND CONTROL

466 – **Lime-Sulphur Wash or Polysulphides of Calcium as Fungicides.** — See No. 478 of this *Review*.

467 – **Copper Carbonate as a Substitute for Copper Sulphate in the Control of Wheat Smut.** — See No. 469 of this *Review*.

DISEASES OF VARIOUS CROPS

468 – **Experiments on Wheat Smut (*Tilletia Tritici*).** — STRAMPELLI, N., in the *Rendiconti delle sedute della Reale Accademia dei Linei*, Classe di Scienze fisiche, matematiche e naturali, 2nd Half-Year, 1919, Vol. XXVIII, Parts 3-4, pp. 151-153. Rome, 1919.

The author found, in 1918, that "Apulia" wheat, grown over an area of some 7 hectares, was completely free from smut (*Tilletia Tritici* = *T. Caries*), while the other varieties grown near by, especially the "Luigia Strampelli" variety, were fairly severely attacked. In consequence, he has attempted to find whether this difference in behaviour was due to chance or if there was a difference in the susceptibility of these different varieties of wheat to the parasite.

Accordingly, he experimented with the following varieties :— Bianchetta, Cervara, Luigia Strampelli, Gregorio Mendel, Baionette Strampelli, Hizakiri, Gentil rosso, Inversable Vilmorin (beardless soft wheats), Maiorca, Carlotta Strampelli, Rieti, Apulia, Akakomughi (bearded soft wheats), Duro di Puglia and Dauno (hard wheats).

Each variety was sown in a large earthenware pot; in the soil of each pot 20 equidistant holes about 3 cm. deep were made. The holes were powdered abundantly with smut spores, and then the caryopses of the variety of wheat corresponding to the number of the pot were placed in each hole, so that, on germinating, the caryopses were in immediate contact with the spores of the fungus.

The following percentages were obtained for each variety when mature : —

The Bianchetta variety gave	26.30	%	healthy	plants	and	25.50	%	healthy	caryopses
» Cervaro variety gave	10.60	»	»	»	»	5.22	»	»	»
» Luigia Strampelli variety gave	0	»	»	»	»	1.03	»	»	»
» Gregorio Mendel variety gave	45.00	»	»	»	»	40.70	»	»	»
» Baionette Strampelli variety gave	20.00	»	»	»	»	12.60	»	»	»
» Hizakiri variety gave	5.00	»	»	»	»	10.97	»	»	»
» Gentil rosso variety gave	10.50	»	»	»	»	10.80	»	»	»
» Inversable Vilmor. variety gave	15.00	»	»	»	»	18.30	»	»	»
» Maiorca variety gave	10.00	»	»	»	»	10.15	»	»	»
» Carlotta Strampelli variety gave	42.10	»	»	»	»	36.20	»	»	»
» Rieti variety gave	10.60	»	»	»	»	10.20	»	»	»
» Apulia variety gave	43.75	»	»	»	»	41.26	»	»	»
» Akakomughi variety gave	13.60	»	»	»	»	5.55	»	»	»
» Duro di Puglia variety gave	15.00	»	»	»	»	13.90	»	»	»
» Dauno variety gave	0	»	»	»	»	0	»	»	»

These figures show that the different varieties are attacked with varying intensity by the parasite ; thus a scale based on these figures and on the resistance of the varieties tested would be as follows :—

1) Gregorio Mendel (45.00 % of healthy plants)
2) Apulia (43.75 » » »
3) Carlotta Strampelli (42.10 » »
4) Bianchetta (26.30 » » »
5) Baionette Strampelli (20.00 » » »
6) Inversable Vilmorin, Duro di Puglia.
7) Akakomughi.
8) Cervaro, Rieti, Maiorca, Gentil rosso.
9) Hizakiri.
10) Dauno and Luigia Strampelli.

The question as to whether the position of the spores in the soil in respect to that of the caryopses has an influence on the possibility of attack by the parasite was also investigated by the author. For this experiment, Luigia Strampelli wheat was chosen and sown in three pots in the following manner :—

1) In the first pot, 20 caryopses were evenly distributed and covered with a layer of 3 cm. of soil on the surface of which large quantities of smut spores were strewn.

2) In the second pot, two-thirds full of soil, smut spores were strewn until the surface of the soil was black, then a layer of soil 6 cm. thick was placed on top ; 20 wheat caryopses were placed on this and covered with 3 cm. of soil.

3) The third pot was half-filled with earth and smut spores were strewn on it as in the second pot ; a second layer of earth 14 cm. thick was then added, 20 caryopses were sown in it and covered with 3 cm. of soil.

The pot with Luigia Strampelli wheat sown in infected holes as described above was taken as a control.

At maturity, the following percentages were found :—

1) Infection on the soil surface after sowing and covering the seeds with 3 cm. of soil.	Healthy plants	90 % ;	healthy caryopses	82.20 %
2) Infection in the soil under a layer 6 cm. below the caryopses.	»	» 100 % ;	»	» 100,00 %
3) Infection in the soil under a layer 14 cm. below the caryopsis.	»	» 100 % ;	«	» 100,00 %
4) Control pot; caryopses sown in infected holes.	»	» 09 % ;	»	» 1.03 %

While infection was complete when the caryopses was sown in contact with the spores, the percentage of healthy plants at once rose to 90 % when a 3 cm. layer of soil was placed between the caryopses and the spores (case 1 above). The 10 % of smutted plants was certainly due to the fact that spores had been carried by watering from the surface of the soil to the caryopses. There was no infection at all in the other cases.

This shows that, for smut to attack the young plants the spores must be in actual contact with the germinating seeds. Consequently, besides burning the stubble and treating the seed with copper sulphate, the soil should be prepared for wheat by ploughing fairly deeply so as to remove the spores spread on the ground by the wheat as far as possible from the seed. In addition, varieties of wheat should be chosen that are the least sensitive to the parasite.

469 – **Dry Treatment with Copper Carbonate for the Prevention of Wheat Smut.** — Darnell--Smith, G. P. and Ross, H., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Part 10, pp. 685-692, 7 Figs. Sydney, 1919.

Years ago, laboratory and field experiments have led the authors to the conclusion that the copper sulphate solution in which wheat seeds are immersed in order to prevent smut from appearing is clearly injurious, not only to grains that are split or otherwise damaged, but also to healthy seeds, by retarding and, in certain cases even, preventing germination.

After the seed had been treated with the copper sulphate solution, the advice used to be given to immerse it again in lime water made from freshly burnt lime, so as to neutralise the acidity of the copper sulphate. As regards this, the authors think that, apart from the corrosive action of the copper sulphate, simply immersing the wheat in water is more or less harmful to the future plant. For example, if a bushel of wheat is immersed in water for 3 minutes, it requires 8-12 hours to dry. During this period, partial germination takes place and, if the grain is not sown at once in damp ground so that germination may continue, the swollen grains are stopped germinating and, when a second germination takes place some weeks later, when the conditions are again favourable, growth cannot be as healthy and vigorous as if the grains had not begun to germinate once before.

With the object of eliminating the use of water, and of finding a less harmful fungicide than copper sulphate, the authors have carried out

many experiments of recent years and have been led to prefer copper carbonate to all the different dusting powders or gases that had been tried. Copper carbonate, besides being a perfect fungicide, is innocuous to the seed and has the advantage that it can be used in the dry state.

The method finally adopted for treating wheat seeds consists in powdering the seed with dry copper carbonate in the proportion of 2 per 1000. It was found to be essential to cover the seed completely with the copper carbonate powder, which can be better done by using a machine that mixes the wheat and copper carbonate together intimately than by doing it by hand.

The results of cultural tests made in 1917 and 1918 at the Wagga and Cowra Experimental Farms (New South Wales) showed an actual, marked increase in the yield per acre in the cases where the new copper carbonate treatment substituted the old method using a bath of copper sulphate. This increase is positive and, in certain cases, amounts to 100 %.

The advantages derived from the use of copper carbonate instead of copper sulphate can be summarised as follows:—

1) No water is used.

2) There is no injurious action on either seed or young plant such as occurs with copper sulphate.

3) Seed wheat can even be treated several weeks before sowing.

4) No harm comes to the seed if it remains on a dry soil for several weeks without germinating.

5) Better germination is obtained.

6) This method is quicker and less laborious than using copper sulphate solution.

7) A better product is obtained.

8) The total quantity of seed grain required for sowing can be treated when the farmer can best spare the time and not necessarily a day or two before sowing.

470 – **Preliminary Observations on the "Straw-Blight" of Wheat, Oats and Barley in the State of Washington.** — DANA, B. F., in *Science*, New Series, Vol. L., No. 1299 pp. 484-485. Lancaster, Pa., November 21, 1919.

On several occasions during 1918, diseased wheat plants were sent from Olympia and other localities of the western part of the State of Washington to the Agricultural Experiment Station of Pullman for investigation.

Amongst the first specimens received, there were some which, at the base, had elliptical lesions that penetrated through the leaf sheath to the surface of the straw. Plants with these lesions and others with a general blackening of the lower nodes had dead roots from the first node, and the plants had tried to remedy this by giving off roots near to the second node. In certain plants, two rows of roots had been successively killed and still other roots had been given off near the third node. The plants seemed to be of retarded growth and were yellowish in colour.

Further information obtained, particularly from the county of Cowlitz, showed that the disease was the cause of a good deal of lodging, the

stems breaking almost at soil level. From information supplied, the disease had nothing to do with the nature of the soil or the tillage system adopted. It was also observed on oats and barley, but to a slighter degree, with the general blackening of the base of the straw and the death of the roots.

The disease was reported on wheat in the counties of Cowlitz, Snohomish and Thurston ; it was most serious in the county of Thurston while, in the county of Cowlitz, it attacked wheat approaching maturity most severely. It was recorded on barley in Pierce county only, and on oats in Clarke, Pierce and Snohomish counties. The wheat harvest in certain localities of Cowlitz and Thurston counties suffered considerable loss, but no data is available to show that the disease had attacked the other cereals equally seriously.

In 1912, CORDLEY published some notes on a straw-blight of cereals in Oregon, but he only described the disease briefly and did not identify the pathogenic agent. The disease mentioned in this case is certainly the same as that which appeared in 1918 in the western part of the State of Washington. Other signs of the disease in the United States have not been recorded. This disease has either been recently introduced into the United States or has so far escaped notice.

The fungus found in the lesions of the straw was examined microscopically with great care in order to identify it. The mycelium was sterile, dark brown in colour, constricted at the points of origin of the lateral branches, and corresponded fairly well to *Rhizoctonia Solani* Kühn, except in the diameter of the hyphae. In the case of plants showing very marked blackening at the base of the stem, the discoloration was found to be due to a very dense, superficial development of dark-brown hyphae, from which, in certain cases, a sclerotium was beginning to form.

So far, no fungoid fructification has been found with the sterile material at the base of the stem.

However, there seems to be a close similarity between the straw-blight observed in the State of Washington and the straw-blight of wheat and other cereals caused by *Ophiobolus graminis* Sacc. This and other fungi related to straw-blight, produce an ascophorous form on the old straw ; it seems probable that it must be ascertained whether the fungus causing straw-blight of cereals in the west of the State of Washington also possesses a perfect or ascophorous form which hibernates on the stems of the diseased gramineae. It is also possible that the disease exists on the native grasses, and it is known that, by means of the wild host-plants, other fungi that cause straw-blight can be introduced into the crop rotation. Up to the present, it has not been possible to make a careful study in the field with the object of discovering the ascophorus stage. In the limited work carried out, the only perithecial form found on old wheat stubble was a species of *Pleospora*, and it cannot yet be said whether the disease in question is the same as one of the similar diseases that have been studied in Europe or Australia.

Reports show that the disease is fairly widely diffused in the western part of the State of Washington and the notes furnished by CORDLEY seem to show that the disease may have already manifested itself for some years. Only with time can it be ascertained if the disease will attain, in the United States, the same gravity as the pathological manifestations groupe dunder the name of straw-blight of cereals in Europe and Australia.

471 – **On the Silver Leaf Disease in England** (1). — BINTNER, J., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, Nos. 6-7, pp. 241-263, 8 Figs., 1 Pl. London, 1919.

The author's researches lead to the conclusion that there are two types of silver leaf disease, 1) the *true silver leaf*, which is the more common and is caused by the basidiomycete *Stereum purpureum*, and 2) the *false silver leaf*, which is comparatively rare and is apparently due to a physiological weakening of the plant. It is difficult to distinguish between the two forms by external examination as the foliage has practically the same appearance in both cases. *True silver leaf*, however, is characterised by a dark coloration of the wood when seen in cross section, and by the ease with which the upper epidermis of the leaves peels off.

The chief characteristics of *true silver leaf* are as follows :— The normal green colour is obliterated by the presence of air spaces under the cuticle, owing to which the light is reflected and the leaf takes on a silvery appearance. As a rule, there is no reduction in the number of the chloroplasts. As a result of the dissolution of the median lamella of the cell walls of the leaf, the leaf tissues easily fall apart when a section is cut through them. The dissolution of the median lamella is possibly caused by the production of some diffusible toxic substance during the metabolism of the fungus and the invaded cells of the host ; this substance is then conveyed to the leaves by the water ducts where it causes a change in the enzymes which can dissolve the pectic substances of the cell wall. Moreover, infected plants nearly always show continuous dark-brown streaks in the woody tissues of the stem, twigs, branches or roots which, when examined under the microscope, show the presence of extremely fine filaments of *S. purpureum*. If branches suffering from silver leaf are kept in water for 48 hours, they change the colour of the water to a degree of intensity varying with the severity of the attack.

Initial infection takes place just above the soil level, and even immediately below it and, from the information available, the fungus can only penetrate the host by means of open wounds. Recent inoculation experiments confirm the opinion that wounded superficial roots can be infected ; the frequency of the infection probably depends on the variety of stock used for grafting. When the disease is limited to one of the large branches the disease is caused by a local infection and has not yet spread to the main stem. Diseased suckers originating from a healthy tree show that the disease is present in the roots, while the appearance of healthy shoots on diseased plants indicates crown or stem infection that has

(1) See *R.*, August, 1917, No. 775. (*Ed.*)

not yet reached he root system. The author has examined the following plants all of which are subject to *true silver leaf*:— Victoria plum (and the stocks on which this variety is usually grafted, viz., the Brompton plum and Common plum), *Prunus lusitanica*, *P. triloba* var. *fore pleno* amongst apples, the Lord Grosvenor and Bramley's Seedling varieties; *Spiraea japonica* var. *glabrata*, *Neviusia alabamensis*, *Ribes cereum*, *Laburnum alpinium* and *L. vulgare*. Although fructifications of *Stereum purpureum* have not yet been noticed on *Spiraea japonica* var. *glabrata* and *Ribes cereum*, it is certain that the hyphae observed in the tissues of these plants were identical with those of the fungus obtained in artificial cultures.

On account of the frequency and disastrous effects of *true silver leaf* and the ever increasing world-wide importance of the disease, the author particularly recommends the destruction of *S. purpureum* wherever it occurs, whether as parasite or saprophyte.

If the disease is found localised in the upper set branches of a tree, the diseased branches should be cut off below the point where the disease has changed the colour of the wood. If the lower branches are attacked, there is little hope of their recovery because, in this case, the fungus has already invaded the main stem; all that remains to be done is to uproot the tree before the fructifications of the fungus can develop (usually about September).

If a branch is amputated, the stump should be cut as close as possible to the main stem or at its point of origin if it is a secondary branch, the object being to help the callus to form as rapidly as possible. When pruning branches, the cut surface should be at once protected with Stockholm tar or grafting wax to prevent spores of the fungus from penetrating.

All dead or diseased wood should be removed from the plantation, for the fungus in wood quickly develops fructifications whose spores are dangerous to the surrounding trees.

Diseased branches should not be used for fencing as they would be just as dangerous as if they were left in heaps in the orchard. The wood must be stored in very dry places to prevent the growth of the fungus. In large plantations the cut branches should be made into charcoal on the spot.

In plantations where the plough is used for catch crops, it is difficult to avoid damaging the surface roots, but the additional injury due to the use of the spade can be minimised by using it carefully and by the pulling up of suckers. Varieties of plums grown on their own roots produce few if any suckers and, consequently, these varieties should be planted whenever circumstances permit. Varieties of plums that resist or are less susceptible to the disease, such as the Yellow Pershore (also known as Yellow Egg plum) and Early Rivers plums should be planted.

Varieties of apple that produce cookers of the soft type are more subject to silver leaf than the others, which, should therefore be planted in preference.

Certain stocks, suchas the Brompton and Common plums, are very susceptible to the disease, whilst the Yellow Pershore has a certain degree of resistance in addition to other good qualities.

Ornamental trees and shrubs known to be suffering from the disease should not be pruned unless the cut surfaces can be protected immediately after pruning.

When infected plum trees are replanted, the use of varieties such as Victoria and Czar that are already known to be subject to *true silver leaf*, should be avoided, and pears, Cob-nuts or Filberts should be planted between the plums.

False silver leaf is much less prevalent than *true silver leaf*, and can easily be identified by certain microscopic characters. The number of chloroplasts in the leaves is reduced, so that the leaves take on a somewhat silver-lead sheen which is visible even at a distance ; the median lamella is not dissolved and the cells are not broken up. No trace of hyphae has been found in any part of the diseased plant. No continuous streaks are seen in which the wood changes colour and cut branches do not affect the colour of water in which they are immersed.

False silver leaf is sometimes found on apple trees (Grenadier and Bramley's Seedling on *Camelia Sasanqua* var., *Koelreuteria paniculata*) and, rarely on cultivated varieties of Cherry, Peach and Plum trees. It appears that trees or shrubs that have suffered from *false silver leaf* for one or two seasons will resume their normal appearance in the following year if they receive improved cultural treatment.

472 – **Diseases of the Avocado-Pear (*Persea gratissima*), in Trinidad.** — Rorer, J. B., in the *Bulletin of the Department of Agriulture, Trinidad and Tobago*, Vol. XVII, Part 3, pp. 132-133, 2 Pl. Port of Spain, 1919.

As there are no true plantations of *Persea gratissima* in Trinidad, the trees being disseminated in cacao or other plantations, the avocado pear has remained free from serious fungoid diseases.

On account of the interest recently shown by the planters in this fruit tree and as large plantations will probably be established in the island and will give rise to an export trade, the author has considered it a suitable moment for attracting attention to the diseases which may attack the tree and become epidemic, as one at least has already become in other regions.

The sole serious disease observed so far on the fruit of *P. gratissima* is that known as anthracnose, caused by a fungus very similar or closely related to that which causes anthracnosis of the mango, i. e., *Gloeosporium Mangiferae* (*Colletotrichum*) *gloeosporioides*). It is almost impossible to buy a fruit in the market that is not more or less attacked by the disease. As the avocado pear is eaten at once, the disease does not cause serious loss, but, if the fruit is packed for export, they will all rot in a few days.

The disease first shows itself on the fruit by the formation of a very small brown spot. If the attack takes place when the fruit is green, the brown area does not spread, a slight depression forms, and cracks appear all

round the edge of the spot ; black pustules may exist in the centre of the tissue that has gone brown. If the attack is serious, the young fruit falls before it is ripe ; otherwise, the fruit may ripen, but the epidermis cracks round the brown spot. When the fungus attacks fruit with a tender skin, it penetrates the pulp and forms a conical mass of diseased tissue which may extend to the stone, and the fruit gradually rots. Ripe fruit when attacked, rots very rapidly. As in the case of the mango, the fungus also attacks the leaves and, up to a certain point, may cause their fall.

To combat the disease, Bordeaux mixture must be continually sprayed on the tree from flowering time until the fruit is ripe. The wetter the weather, the more the number of sprayings that will be required.

If the fruit has to be sent some distance, it is of primary importance that they should first be sprayed. Even when the skin seems perfectly healthy, avocado pears, in practice, are always infected by the fungus which finds the most favourable conditions for growth when the fruit is packed in baskets or boxes.

It is often noticed in Trinidad that young avocado branches die from the tip downwards. Microscopical examination has shown that such branches are infected by *Diplodia cacaoicola*.It has not been shown yet that this fungus can attack unwounded branches, but it probably penetrates the very young tissues through wounds produced by anthracnose, and, once in the branch, grows rapidly towards the main stem of the tree. The same fungus has been recorded on specimens of grafted avocado pears in which it probably enters by wounds caused by grafting. The method of control recommended for anthracnose is also suitable for this disease.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

473 - ***Thymalus fulgidus*, a Beetle living on *Polyporus betulinus* and *Daedalea confragrosa*, Polyporaceae living respectively on the Birch and Willow, in New Jersey, U. S. A.** — Weiss, H. B., in *Entomological News*, Vol. XXXI, No. 1, pp. 1-13. Lancaster, Pa., January, 1920. GENERA

Thymalus fulgidus Er. has been long known as a coleopteron living on *Polyporus betulinus*, a parasite of the birch. According to various authors, this beetle has been recognised as common on this *Polyporus* in New England, Massachusetts and New Jersey.

During the winter of 1918-19, the larvae of this beetle were very abundant in the fructifications of *P. betulinus* at Morristown, Oradell and Monmouth Junction and in those of *Daedalea confragosa* at Monmouth Junction and High Bridge (New Jersey). These two polyporaceae are common in NewJersey, the former on birch, the latter on dead wood, but chiefly on living willows.

The adult beetles, like the larvae, live on the contexts and tubes of the host fungus and when numerous the fructifications are completely riddled.

MEANS OF PREVENTION AND CONTROL

474 - **Parasites of the Maize Pyralid (*Pyrausta nubilalis*), in France** (1). — VUILLET, A., in the *Bulletin de la Société entomologique de France*, No. 17, pp. 308-309. Paris, 1919.

Fifteen larvae of *Pyrausta nubilalis* Hb, from the south-west of France were reared, and six were found to be parasitised in 1919. Two unidentified hymenoptera emerged from two larvae of the pyralid; from another two caterpillars two specimens were obtained of the tachinid fly *Paraphorocera sculis* Rondani; a fifth gave rise to the tachinid *Lydella stabulans* Mg.; the pupa of a parasitic fly was also obtained but it did not hatch. The two identified species are common and parasitise various larvae.

Different species of birds hunt for the larvae of *Pyrausta* in the stems of maize.

475 - ***Charips* (*Charips*) *leguminosa* n. sp., a Hymenopteron obtained from *Aphis bakeri* in Idaho, U. S. A.** — WELD, L. H., in *Entomological News*, Vol. XXXI, No. 1, pp. 14-16. Lancaster, Pa., January, 1920.

The author describes as new to science, under the name of *Charips* (subgen. *Charips*) *leguminosa*, a cynipid reared from *Aphis bakeri* Cowan (the clover aphis) in June-July, 1919, at Twin Falls, Idaho, by Mr. R. H. SMITH. The latter repeatedly attempted, without success, however, to rear the cynipid as a parasite of the aphid; he twice reared the hymenopteron in cages with *Aphelinus lapsiligni* Howard, the chief parasite of that aphid. For this reason he is inclined to believe that the cynipid is not a primary parasite but a parasite of *Aph. lapsiligni*.

476 - ***Apantales gabrielis* n. sp. a Hymenopterous Parasite of *Pionea forficalis*, a Microlepidopteron Injurious to the Cabbage in France.** — GAUTIER, Cl., and RIEL, PH., in the *Bulletin de la Société entomologique de France*, No. 17, pp. 309-312. Paris, 1919.

Description of a species new to science, under the name of *Apanteles gabrielis*, a braconid parasitic on the larvae of *Pionea forficalis* L. (*Pyralidae*), which, in 1919 (June-July, and September-October), attacked in great numbers a cabbage crop very seriously at Monplaisir, near Lyons. Just under half the larvae of *Pionea* were parasitised by the new braconid.

Contrary to what takes place with most species of *Apanteles*, the larvae of *A. gabrielis* emerge, under natural conditions, from the larvae of *P. forficalis* when these are hardly more than half grown.

477 - **Researches on the Food of Certain Wild Birds in Great Britain.** — COLLINGE, W. E., in *The Journal of the Board of Agriculture*, Vol. XXV, No. 6, pp. 668-691, 7 Figs. No. 12, pp. 1444-1462, 9 Figs. London, September, 1918 - March, 1919.

The author has examined the contents of the stomach and crop of 3670 adult birds and 595 nestlings, embracing 9 wild species. From the results obtained, he concludes that the volumetric method, i. e., the percentage of the total volume represented by each food, is the only reliable method for judging the nature of the food of a bird and its true economic value; that the numerical method is highly misleading and may lead to

(2) See *R.* Oct.-Dec., 1919, No. 1289. (*Ed.*)

wrong conclusions ; that, consequently, all the work done with the help of the latter method on the food of wild birds is of doubtful value, and should be begun again, using the volumetric method.

Of the 9 species examined, the house sparrow (*Passer domesticus*) and the wood pigeon (*Columba palumbus*) are distinctly injurious ; two, the rook (*Corvus frugilegus*) and the sparrow-hawk (*Accipiter nisus*) are too numerous and, consequently injurious ; locally, the missel-thrush (*Turdus viscivorus*) is common ; four, the skylark (*Alauda arvensis*), the green wood pecker (*Gecinus viridis*), the kestrel (*Falco tinnunculus*) and lapwing (*Vanellus vulgaris*) are decidedly useful.

In the interest of agriculture energetic measures should be taken against the house sparrows and wood pigeons and all the orders for the protection of rooks, sparrow-hawks and missel thrushes should be revoked. But no effort should be spared to protect skylarks, green wood peckers, kestrels and lapwings.

In the second article, which continues the previous one, the author gives the results of examining the stomach contents of 798 adult birds and 166 nestlings embracing 8 species of wild birds. It was found that the jackdaw (*Corvus monedula*), the greenfinch (*Emberiza citrinella*), the great tit (*Parus major* subsp. *newtoni*), the blue tit (*Parus caeruleus* subsp. *obscurus*), the thrush (*Turdus musicus*) and (*T. pilaris*) are very beneficial.

The great tit, blue tit and fieldfare are so useful that they ought to be protected.

In spite of the damage it does, it would be a mistake to advocate repressive measures against the chaffinch (*Fringilla coelebs*). The starling (*Sturnus vulgaris*) has been allowed to increase unduly, with the result that it does more harm than good.

Temporary measures of repression against this bird would certainly keep its numbers down to normal limits, with considerable benefit to farmers and fruit-growers.

478 – **On the Mixture consisting of Lime-Sulphur or Polysulphides of Calcium as Insecticide or Fungicide.** — Report of Prof. BRUTTINI. Rome, L'Universelle, Imprimerie polyglotte, 1920, pp. 36 + 6 Figs.

This report deals with the preparation of " an old remedy prepared in a new way ". In fact, instead of making lime-sulphur mixture (1) with definite proportions of lime and sulphur which are treated with boiling water, the author, according to his patented process, produces polysulphides of calcium in a super-concentrated mixture at 35°-40° Baume, by using, instead of commercial sulphur, that produced by purifying lighting gas in a special way. This constitutes a new use for this residual sulphur, which is now being produced at the gas-works in Rome belonging to the " Società Anglo-Romana ", where a special plant designed for continuous running has been installed.

The method of preparation is not given, but a description of the product, which is sold under the name of " Supersolfo ", is given. Its charac-

(1) See *R.*, May, 1918, No. 613 and *R.*, July, 1918, No. 826. (*Ed.*)

teristics are as follows : Density from 35°-40° B. ; absence of residue ; very intense chestnut-red colour which turns to red when it is diluted with water ; characteristic strong smell ; great resistance to the action of the air, i. e., there is not a continuous formation of insoluble crystals of calcium sulphite, as is the case with the mixture made from commercial sulphur ; and, finally, a fair content of iron in the soluble state, not combined with cyanogen. This characteristic is very important, for the vigorous action of polysulphides when sprayed on plants, due to the sulphur, is, in this case, certainly increased by the action of the iron.

The author describes the serious damage caused by parasites to cultivated plants and, basing his calculation on figures published before the war (2) but trebled or quadrupled in order to bring them into line with present prices, estimates that agriculture in civilised countries loses the enormous amount of 10-20 milliard francs owing to this cause.

In the chapter on the history of the lime-sulphur mixture, the author quotes numerous results of experiments in different countries, all agreeing on the efficacity of this remedy, and gives a list of 34 American works that make polysulphides of calcium for agricultural use. Though this list is not complete, ii shows what a large use is made of this insecticide and fungicide by American horticulturists.

The chemical composition of the mixture — which is very complex — is still uncertain, but it can be assumed that it is a solution of calcium tetrasulphide and pentasulphide with small quantities of hyposulphite. Polysulphides, being very easily oxidised, decompose in the presence of air, giving, in the order of formation : 1) tetra or pentasulphide of calcium ; 2) hyposulphite of calcium and sulphur ; 3) calcium sulphite and sulphur ; 4) calcium sulphate.

The same changes take place on the leaves, on which sulphur is deposited in a much finer state than ground sulphur, owing to which it is more active. Various opinions have been advanced to explain the action of polysulphides on parasites of plants ; some attribute it to the action of sulphur vapour, and some to the oxidation of the sulphur with the production of sulphur dioxide. The production of sulphuretted hydrogen by the action of the carbon dioxide of the air should also be considered. In addition, polysulphides rapidly extract the oxygen from insects, thus disorganising their tissues and even asphyxiating them.

In diluting " Supersolfo ", the author starts with the basal mixture (at 21-24° B.) and suggests its use at 8 to 10 % strength for spraying in winter and at 5 to 6 % for that in spring and summer. As the density is 35-40° B., the amount of mixture per 100 litres of water is from 2.90 to 4 litres for winter use and 1.80 to 2 litres for spring and summer use.

A list is given of the chief scales, injurious insects and fungi that can be successfully treated with polysulphides : *Tetranychus telarius ; T. mytilas-*

(2) Cf. Louis-Dop : *Rapport sur la coopération internationale dans la lutte contre les maladies des plantes.* International Phytopathological Conference (Rome, Feb. 24, 1914). International Institute of Agriculture, Rome, 1914). (*Ed.*)

pidis ; " bianca-rossa " of *Citrus* spp., *Chrysomphalus dictyospermi ;* fig scale, *Ceroplastes rusci ;* peach scale, *Lecanium persicae ;* black olive scale, *Saissetia oleae ;* apple aphis, *Schizoneura lanigera ; Hyponomeuta malinellus* on apple ; apple pyralid, *Carpocapsa pomonella ;* peach-leaf curl, *Exoascus deformans ;* plum pockets, *Exoascus pruni ;* loose smut of wheat, *Ustilago tritici ;* wheat smut, *Tilletia tritici* ; powdery mildew of peach and rose, *Oidium leucoconium* (*Sphaerotheca pannosa*) ; brown rot of fruit, *Monilia fructigena* (*Sclerotinia fructigena*) ; " occhio di pavone " of olive, *Cycloconium oleaginum ;* powdery mildew of grape, *Oidium Tuckeri ;* apple and pear scab (*Fusicladium dendriticum* and *F. pirinum*), etc.

A special note is given on the powdery mildew of the grape (*Oidium Tuckeri*), against which polysulphides were successfully tried some years ago ; the experiments are being taken up again. The author quotes, in respect of this, the favourable opinions expressed by PEYRON, D' OTTAVI and the more recent ones of SAVASTANO in Italy and CAPUS in France, and it recommends that a large use should be made of polysulphides against this parasite of the vine, especially as polysulphides are much cheaper than powdered sulphur.

The author also draws attention to the effect of polysulphides on mites and insects that live on domestic animals.

The report concludes with a list of 64 works on the subject.

479 - **The Almond Scale (*Eulecanium coryli*) in Italy.** — SILVESTRI, F., in the *Bollettino del Laboratorio di Zoologia generale ed agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XIII, pp. 127-192 + 34 Figs. Portici, 1919.

INSECTS, ETC INJURIOUS TO VARIOUS CROPS

Morphological and biological description of *Eulecanium coryli* L., found by the author on the following plants : — hazel, pear, apple, plum (wild and cultivated), maple, elm, hawthorn, azerole-tree, golden willow and hornbeam. It has also been recorded by various authors on many other plants as well as these.

E. coryli is known in Sweden, Denmark, England, Holland, France, Germany, Bohemia and Italy, and it has apparently been introduced into North America. In Italy the author has found it in the provinces of Macerata, Perugia, Campobasso, Avellino, Caserta, and Naples, and it is said to occur in Sardinia.

This scale, by sucking the juices of its host-plants, damages them directly by removing their food substances. The female scale sucks most sap at the end of winter and in early spring, as then it needs it to complete its growth speedily. As a rule, not many specimens of the scale can be found on a given plant ; thus, they cause little damage, but, in certain years and localities, they may attack a plant in numbers, in which case the damage done is proportional to the number of scales and may lead to the death of the plant.

As regards natural causes that hinder the development of *E. coryli*, amongst the first and least active as regards their direct action, are climatic conditions, because temperature, in respect of this scale, cannot cause its death either by increasing or diminishing in the limits within which these

variations take place in Europe. Rain may be directly harmful mechanically if it falls violently at the time when the larvae are hatching and the same applies to wind.

Temperature, rain and manuring can have a greater indirect influence in regard to favouring the development of the insect, because they may put the plant into a state that is favourable or unfavourable to the life of the coccid. The state of the plant that is most favourable to the insect cannot be shown with precision, but an important factor seems to be the abundance and especially the superabundance of sap, because, in the greenhouse, with much watering, a relatively large number of larvae can be got to survive in certain cases. The larvae of the first stage die in large numbers for reasons that are not yet known with certainty.

Amongst the biological conditions that have been noted as unfavourable to the insect, the presence is specially important of certain inidentified fungi that cause their death, particularly of larvae of the first and second stages. The following insects, some of which have been already noted by other authors, are very important in this respect:

a) Coleoptera — *Chilocorus, bipustalatus* L.; *Exochomus 4-pustulatus* L.; *Anthribus fasciatus* Forster.

b) Hymenoptera: — *Encyrtus infidus* (Rossi) Latr.; *Blastothrix sericea* (Dalm.) Mayr, in turn attacked by *Pachyneuron coccorum* L.; *Aphycus punctipes* (Dalm.) Mayr, also attacked by *Pachyneuron coccorum*; *A. philippiae* Masi; *Coccophagus scutellaris* Dalm.; and *Microterys sylvius* (Dalm.) Thoms.

The author gives a biological and morphological description of nearly all these natural enemies of the scale.

480 - ***Coelosterna scabrata*, a Coleopteron Injurious to *Casuarina equisetifolia* in Réunion.** — LESNE, P., in the *Bulletin de la Société entomologique de France*, No. 17, pp. 301-302. Paris, 1919.

The Entomological Laboratory of the Natural History Museum of Paris has recently received from St. Denis, Réunion, some specimens of a longicorn beetle that is injurious, as a larva, to young plants of *Casuarina equisetifolia* in the island.

The author identified this insect as *Coelosterna scabrata* F., a common species in many parts of India, but hitherto unknown in Réunion, where it is apparently a recent introduction.

ALFREDO RUGGERI, *gerente responsabile.*

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

481 - **Beriberi and Deficiency Diseases.** — SCALA, A. Beriberi e Malattie per carenza, *Rivista critica*, Extract from the *Annali d'Igiene*, Year XXIX, Part. V, pp. 32. Rome, 1919. RURAL HYGIENE

Critical review of the numerous papers published on this subject and discussion of the very diverse opinions expressed on the etiology and treatment of deficiency diseases. The author also expounds the theories that he has formed in the course of his own researches.

After an introduction dealing with beriberi, the first part summarises the papers on the etiology of the disease, experimental beriberi and vitamines, and the specific action of vitamines. In the second part, a detailed discussion is given on the composition of the different foods, the nature of vitamines and their antiberiberic or antiscorbutic action respectively

The conclusions arrived at in the first part are as follows :—

1) Polished rice is really the cause of the beriberi epidemic in places where it is abundantly or almost exclusively used in the ordinary diet.

2) All foods, when eaten alone for a varying length of time, are sure to cause an organic disturbance which finally turns to a true disease of the type of beriberi or scurvy are also varied.

3) These two diseases are caused by the lack, in each food, of *accessory* substances called *vitamines*. These are specific and different for each disease of the above-mentioned group, just as the vitamines that favour growth.

4) The chemical nature of these accessory substances is uncertain and the many authors who have investigated it do not even agree on this point. They apparently are alkaloids of the pyrimidine or hydroxypyridine

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group, which decompose on heating owing to a rearrangement of the atoms in the molecule, i. e., the reversible transposition called *physiological isomerism.*

5) The anti-beriberi vitamine is destroyed by heating at 120°C. for a short time and is only slightly changed by heating, even for a long time, at 100° C., Again, the anti-scorbutic vitamine is quickly decomposed when the substances which contain it dry up naturally, as well as by heating to 100° C., or even less, for a short time. The vitamine which favours growth resists even prolonged heating at 100° C. and over.

For these reasons it may be supposed that vitamines or accessory substances in their natural state are not simple substances and that the extracts that have this character, though they undoubtedly have a curative action on polyneuritis, are not true vitamines but different substances which exist either in the same state in the raw materials or as decomposition products of vitamines or other substances.

The author inclines towards the former hypothesis, especially because it is certain that vitamines are not stable, and, consequently, are easily decomposed. : — (*a*) simply by drying (anti-scorbutic vitamine) ; (*b*) by exposure to temperatures of varying height in the presence or absence of water (anti-beriberi vitamines) ; (*c*) by the action of caustic alkalis.

This is by no means of an alkaloid character, but that of enzymes, diastases, toxins, toxo-proteins and special complex substances constituted by two parts, one organic, one inorganic. The author's personal opinion is that vitamines are probably true *colloidal* complexes possessing as well as the properties mentioned above, other special and characteristic properties. In fact, vitamines, like all colloids, are retained so firmly by animal charcoal as to make it impossible to separate them ; they are fixed by aluminium silicate, but can be separated from it by an alcoholic solution of sodium, which is a solvent of organic and protein matter in general ; and they are precipitated by tannin.

Theoretically and practically, so the author thinks, the hypothesis can be supported that vitamines are colloidal complexes, possibly constituted by an organic and inorganic part, and which can provide the central nervous system with the quantity of salts it needs in order to function and maintain the essential equilibria. Again, it is not improbable that deficiency diseases are due to defects in the inorganic nutrition, especially of certain parts of the body, owing to the lack of substances which can transport the salts and act as diastases. This is the cause of the disturbances which, in time, turn to disease and inevitably lead to death.

There is no doubt that when certain salts, or a mixture of certain salts and the ash of cereals that produce beriberi are added to a beriberic ration, the disease is neither prevented nor cured. This, however, is not a final proof, because the salts in question are not in the same form as those in the food, so that they cannot act like them, and cannot nourish certain parts of the organism, for they are at first kept back, then eliminated. In fact, BUNGE found that the value of salts combined naturally with organic matter (complexes) is very different from that of salts not so combined.

When the composition of food materials is examined, not by the crude analysis (which is of limited or at least incomplete biological significance), but by an analysis which takes into account the *state* in which the constituents occur, a fact can be observed which, though hitherto largely neglected, is very important, and which is *the transformation of the organic phosphorus into inorganic phosphorus, accompained by a rise in temperature*, and, *usually, by the decomposition of the complexes by heat or even by simple desiccation.*

Thus, FRANCIS and TROWBRIDGE have shown that cold water extracts the phosphorus in meat at the rate of 52-65 % in the organic state and that, if the solution is heated above 50°C., the organic phosphorus gradually passes into the inorganic condition, while all of it passes into the inorganic state when heated to 100°C. The change from organic to inorganic phosphorus also takes place in milk.

Certain complexes can be decomposed simply by drying ; this is why dry cereal grains contain no anti-scorbutic vitamines, which are very labile complexes liable to decompose more easily than the much more stable anti-beriberic vitamines. However, the former vitamines reappear when the seed germinates, i.e., when synthetic activities recommence.

These facts contradict the generally accepted opinion that vitamines are alkaloids, for the latter are so stable that they are affected neither by drying nor heating to 100° C., or over.

It becomes more and more probable that deficiency diseases are due either to defective nutrition in salts, to the lack of some acid or base, or to the lack of complexes which can transport the inorganic materials. In the case of scurvy, the lacking inorganic matter probably consists of earthy phosphates in the state of complexes that are easily decomposed by heat and drying, while in the case of beriberi, it probably consists of alkaline. phosphates.

The proteins of rice and maize have been accused of incompleteness, thus respectively causing, beriberi and pellagra in persons whose diet is almost exclusively composed of one or other of these cereals. But it has been shown that the protein of rice is almost complete (only tryptophane is wanting) and that it has a food value equal to $^4/_5$ that of milk casein. This protein, therefore, is no more the cause of beriberi than the zein of maize is of pellagra, for a food composed exclusively of maize never produces that disease in rabbits, though it does cause scurvy, as is the case with all the cereals.

CONCLUSIONS. — (1) In considering how beriberi and scurvy arise, great importance should be attached to the inorganic constituents of the ration when they do not constitute a balanced and physiologically complete whole, and when they are not present in the form of colloidal complexes that can transport them to parts of the organism where they could not otherwise penetrate. It is true that no appreciable benefits were obtained by adding to the daily beriberic ration various inorganic materials whether alone, or mixed, with or without organic salts. Again, it is also true, that, in this way, the conditions in which the inorganic materials occur in

the food are not reproduced and that the defective ration is not compensated. Consequently, all the experimental results hitherto obtained are deduced from faulty hypotheses and are erroneous.

2) The continuous use of a single food in which the inorganic matter is not complete, leads to beriberi, which is a form of acidosis, and to scurvy also a form of acidosis, aggravated by the retention of the earthy phosphates owing to the fact that heating has destroyed the corresponding complex which nourishes the bones.

3) The proteins of rice are not the cause of beriberi, and neither is zein the cause of pellagra.

The former are complete, as they contain all the amino acids necessary for the synthesis of animal proteins.

482 - **The Anti-scorbutic Value of Dried and Germinated Seeds.** — CHICK, H. and DELF, E. M., in the *Biochemical Journal*, Vol. XIII, No. 2, pp. 199-218, 5 diagr., bibliography of 16 publications. London, July, 1919.

By means of feeding experiments on guinea-pigs, described in detail by the authors, the following facts were established :—

Evidence was obtained confirming FÜRST's observation that the content of anti-scorbutic accessory factor in dried peas and lentils increases greatly on germination. The anti-scorbutic value of the seeds, after soaking in water for 24 hours and germinating for 48 hours at room temperature is 5 or 6 times greater than that of the same seeds when dried, and, though lower than the anti-scorbutic value of orange or lemon juice, or of the cabbage or swede turnip, it is equal to that of several other vegetables such as runner beans and potatoes, and greater than that of the carrot or beet.

But these seeds, dried or germinated, do not contain sufficient growth promoting factor to give satisfactory growth in the absence of milk from the diet. It seems probable that it is the fat-soluble vitamine that is deficient.

A considerable proportion of the anti-scorbutic power produced in germinated seeds is destroyed by boiling ; consequently, these germinated seeds should be cooked as quickly as possible.

WILTSHIRE (*The Lancet*, London, December 14, 1918) has shown that germinated runner beans can be successfully used in the treatment of human scurvy. The authors quote other proofs, furnished by feeding experiments on human, diets, showing that germinated grains and their products are useful in preventing human scurvy.

483 - **Relative Anti-scorbutic Value of Fresh, Dried and Heated Cow's Milk.** — BARNES, R. E. and HUME, E. M., in *The Biochemical Journal*, Vol. XIII, No. 3, pp. 306-328. Cambridge, November, 1919.

Raw cow's milk is one of the poorest of foods from the anti-scorbutic point of view. Thus, whereas 1.5 to 10 gm. of various raw fruits and vegetables suffices to prevent the appearance of scurvy in the guinea-pig fed on a diet free from other anti-scorbutic foods, from 100 to 150 gm. of raw cow's milk is necessary to obtain the same result. It has been

suggested, based on theoretical grounds, that dried milk should have a still lower anti-scorbutic value than raw milk, while many medical experts state that dried milk is a satisfactory substitute for fresh milk as the sole food for children, with no danger of scurvy from its use. The authors set out to investigate the problem experimentally and have made the following observations :—

Guinea-pigs kept on a diet of oats, bran and milk showed no signs of scurvy ; they did show signs, however, when the milk was replaced by an equivalent quantity of dried milk whether recently made (1 or 2 weeks) or not freshly made (1 to 6 months).

In experiments on monkeys, scurvy was prevented by the use of raw milk and of milk brought rapidly to boiling point then immediately cooled, but it was not prevented when dried milk was used.

Drying deprives milk of nore of its efficacity as a growth-promoting food.

Cow's milk produced in summer is of greater value against scurvy than that produced in winter. This is because of the difference of feeding between the two seasons : grass in the former, oilcake, hay, cereals and roots in the second. Feeding with swedes and turnips, on the contrary to feeding with mangels, apparently gives a milk of somewhat higher anti-scorbutic value.

In consequence, when children are fed with dried milk, they should be given some anti-scorbutic food as well ; the raw juice of oranges, swedes and tomatoes are particularly useful in this respect.

484 - **The Stability of Lactalbumin when Heated.** — Emmet, A. D. and Luros G. O., in *The Journal of Biological Chemistry*, Vol. XXXVIII, No. 2, pp. 257-265 + 7 diagr. Baltimore Md., June, 1919.

Apparently, there exists a certain specific and characteristic difference between the growth-promoting value of casein and lactalbumin. The authors took up the subject with the object of finding whether heat has the same destructive action on the food value of lactalbumin as that observed by MacCollum and Davis on the nutritive value of casein.

The experiments were carried out with rats. The results show that :— (1) High temperatures do not affect the growth-promoting value of lactalbumin as a growth-promoting food if it is dried *in vacuo* at 55° C. or heated in a hot-air oven at 90-100°C. for 16 hours, or in an autoclave at 10 atmospheres pressure for 2 or 6 hours ; (2) the amount of butter fat (5, 18, 28 %) used with the lactalbumin, heated in the autoclave for 2 hours, has no influence on the rapidity of growth ; (3), heated lactalbumin is not toxic to young growing rats ; (4) confirmation is obtained that lactalbumin is of great value as a growth-promoting substance, and the authors put forward the hypothesis that it contains a factor of the nature of a vitamine, but different from water soluble B.

485 - **Availability of Carbohydrates in Certain Vegetables.** — Olmsted, W. H, in *The Journal of Biological Chemistry*, Vol. XLI, No. 1, pp. 45-48. Baltimore, Md., January, 1920.

The extensive use made of certain vegetables with a low carbohydrate content, such as spinach cabbage, cauliflower and lettuce, in a diet for a

diabetic person, makes it desirable to know exactly how much sugar-forming matter is contained in these foods. The author investigated the question in the laboratory of biological chemistry of the Washington University School of Medicine, Missouri, U. S. A. The methods used consisted either in analysis with the use of diastases and copper reduction, or by feeding phlorodzinised dogs to which phlorodzin and adrenaline had been given after 48 hours of fasting (method of SANSUM and WOODYATT, described in the *Journal of Biological Chemistry*, Vol. XXIV, p. 327, 1916). The results are summarised in the appended table, which also gives the results obtained (by difference) in previous work by ATWATER and BRYANT (*U. S. Dept. of Agriculture, Bulletin* 28, revised, 1906).

Availability of carbohydrates of certain vegetables.

Vegetables	Analytical method		
	With taka-diastase	Phlorodzinised dog	ATWATER and BRYANT
Cabbage	4.4 %	5.0 %	4.5 %
Cabbage cooked thrice	0.4	0.5	—
Cauliflowers	2.8	3.4	3.7
Cauliflowers cooked thrice	0.8	0.8	—
Spinach	—	1.2	2.3
Lettuce	1.0	—	2.2

CROPS AND CULTIVATION

RICULTURAL ETEOROLOGY

486 – **On the Thermal Differences between the "Ubac„ and "Adret„ of a Lacustrine Valley.** — GAIN, E. and GAIN, G., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 3, pp. 191-194. Paris, January, 1920.

The differences of vegetation found at the "ubac" and "adret" of a valley are usually thought to be the result solely of the thermal conditions :— the sum of useful temperatures, the earliness with which the snow melts away, the earliness of thawing, the duration of direct insolation, etc. The authors have carried out observations on the thermal difference to be found in summer in the climate of the east of France between the two slopes of a lacustrine valley (Gérardmer valley), running approximately from east to west. The slope situated to the north of the "thalweg" (valley floor), and which, consequently, faces south, has "adret" characters which are especially shown by phenological advances in the phenomena of flowering in spring.

On the floor of the valley, the lake forms a large mass of deep water of slight variability as regards temperature in summer. The lake clearly separates the influences totalised by each of the two slopes of the north and south banks. Thermometric observations with the help of special instru-

ments were carried out to the accuracy of 0.125°C. In order to bring out the general bearing of the thermal profile orientated NS perpendicularly to the axis along which the valley is orientated, the authors chose the second part of a dry period that extended over August and September, 1919.

After many preliminary experiments, with the object of avoiding sources of error, the authors took as a basis the simultaneous recording of the temperature of the soil, at 10 cm. deep under vegetation like that of short turf (mowed meadow).

The observation points were at an altitude of 660 to 800 m. This slight difference in level cannot give a regular series of temperatures that decreases as the observer goes higher up the two slopes.

On September 5, 1919, 9.30 a. m. (at 10 cm. deep, in the shade):—

Soil temperatures at the "ubac" (Xetté): 2.25° to 12.5° C.

Soil temperatures at the "adret" (Les Xettes): 13.5° to 15°C.

Averages	Adret	14°25°
	Ubac	13.375°
	A — U	0.875° C

On a hill situated in the valley, a thermal profile orientated east-west gave, in the afternoon, $A—U \times 1.625°$ C.

After one month of summer drought, the differences of the 9 temperatures of the ubac and adret are minimum therefore, and hardly more than 1° C. The authors sought for another characteristic in the temperature of the water draining from the two slopes at the moment when it arrives near the lake.

The authors have repeatedly noted, approximately at the same time, the temperature of the water and of the soil washed by the nine tributary streams, of which 3 at the adret and 3 at the ubac were comparable, having a similar course and flow. The following averages were obtained :—

(1) *Temperature of the water at a depth of 10 cm. :—*

Adret	R No. 1	16.5° C.	average 15.16° C
	» No. 2	16°	
	» No. 3	13.25°	
Ubac	R No. 1	14.5° C.	average 13.16° C
	» No. 2	13°	
	» No. 3	12°	

(2) *Temperature of the soil at 10 cm. below the bed of the stream :—*

Adret	R No. 1	16° C.	average 15.16° C
	» No. 2	16°	
	» No. 3	13.5°	
Ubac	R No. 1	14.5° C.	average 13.25° C
	» No. 2	16°	
	» No. 3	12.25°	

Difference between the adret and ubac : $A — U = 1.91°$ C.

The temperatures were also taken of the springs, the water of the lake and of the lake side ; these were :—

(1) *Minimum temperature of the spring* :—

At the adret (Haut des Xettes)	10.25° C.
At the ubac (Roche du Lac)	7.25° C.
$A - U =$	3°C.

(2) *Temperature of the (surface) water of the lake* : 19.5° C.

(3) *Temperature of the air one metre above the soil* : 20° C.

(4) *Temperature of the shores of the lake* (September 3, 1919, 10.30 a. m.) :—

	Dry soil in the shade shore wave-washed	Limit of soil wet by lake	Stream water	Lake water near the shore
Adret	14°C.	16.75°C.	13°C.	18°C.
Ubac	12°–12.50°	12.5°	12°	17°
$A - U =$	1.5°–2°C	4.25°C	1°C	1°C.

487 – **Experiments in Agricultural Meteorology Relating to Wheat made at the Higher Agricultural Institute, Lisbon.** — FIGUEIREDO FILIPPE, E. A., in the *Boletim da Associação da Agricoltura Portuguesa*, Year XXI N.o 8, pp. 251-264. Lisbon, August, 1919.

The latest observations confirm the previous discovery made by the author of the existence of an inverse ratio between the yield and rainfall during growth. Similar conclusions have also been arrived at by TELES DA SILVA MENEZES, Director of the Agricultural Station of Figueira da Foz (1918-19).

It was found possible to deduce with the greatest accuracy from observations extending over 7 years the following critical period :— The February rains have the most marked action on growth, and years of good and bad harvests coincide exactly with the years having a dry and rainy February, respectively.

In 1918-1919, wheat was sown thrice in the experiment field, once on December 15, once on February 1, and once on March 1. The following crops were obtained :—

December 15	7.5 times the seed
February 1	8.0 » » »
March 1	9.7 » » »

The distribution of the rain was as follows :—

	Crop in		
	December	February	March
From first rains to sowiug	35.9 mm	295.4 mm	338.9 mm
From sowing to coming up	71.6	39.9	36.5
From coming up to tillering	**186.7**	**16.2**	**11.7**
From tillering to earing	179.9	135.2	107.3
From earing to harvest	20.3	7.7	0.0
Total (from sowing to harvest)	**458.5** mm	**299.0** mm	**155.5** mm

It will seen that, in every case, the rain is scanty during the critical period of growth. In the years of good harvest, in fact (13.7 times the seed), the rainfall between coming up to tillering is, on an average, 325 mm.

But, on account of the favourable conditions as regards rain (especially the March sowing), the harvest was that of poor years. The cause is the almost absolute lack of rain during the period from earing to harvest, aggravated by a sudden rise in temperature in the second half of May or in the first half of June. There was thus slight lodging, and the grains, owing to hastened ripening were badly formed and of inferior quality.

488 - **The Drought in 1919 in Touraine (France) and its Effects on the Vines, particularly on Direct Hybrid Bearers.** — CHAUVIGNÉ, A., in the *Revue de Viticulture*, Year XXVII, Vol. LII, No. 1342, pp. 197-199. Paris, March, 1919.

In 1919, there was a very rare and highly interesting meteorological case, in so much as a drought compatable to that of 1893 put to test the different vines that are studied and preferred by many growers.

It may be said that, in Touraine, April 15 was the end of a long period of rain, which had soaked the soil with water that took a long time to soak into the subsoil. Except for a few successive stormy downpours, the dry season began at that moment. The heat increased on May 10 in an unbroken wave that reached its maximum on June 11 with a minimum of + 12° C in the night, a maximum of + 33° C in the shade at noon, and + 50° in the sun among the vines... A temperature of as much as + 52° C was even registered at noon in the sun on June 16.

After that date, the heat diminished, but not a drop of rain fell until June 25, after which, up to August 8, there were only a few slight showers, which were so eagerly absorbed by the dry ground that no traces were left. Then began the period of great heat, which reached its maximum on August 13, 14 and 15, with temperatures of at least 16.5° C at night, +32° C in the shade at noon and 50°C. in the sun. This heat afterwards decreased, but the period without rain lasted until the showers on September 20, and the more abundant rain on Sept. 27 which decided the fate of the crop.

The grafted vines and the hybrid direct bearers behaved differently with regard to the drought.

The " Cots " and " Bretons " as well as the " Grolleaux ", in spite of their great resistance, showed the effect, especially in arid soils, by the drooping of their leaves. The bunches ceased to develop, the grapes did not increase in size, growth was slowed down, and no advance towards maturity was made until the first rains in September. In the following fortnight, the basal leaves, which were still green, regained vigour, the grapes developed normally, although late, and the harvest was plentiful and of good quality.

By means of a comparative examination, the author found that this was by no means the case with hybrid direct bearers.

At first, at the moment when the floral clusters emerged, it was noticed that their number was somewhat reduced and that, whilst the French vines had vigorous bunches with fine petals, the hybrid bearers had only small ones. Then the drought came, and soon profoundly affected the hybrids in every part ; the leaves, for the most part, dried up, showing that growth was entirely stopped. The bunches had undeveloped grapes consisting of fleshy, very acid pulp enclosed in a thick, tough skin.

When the rains came and decided the fate of the crop, it was found that they had come too late, as the drooping leaves no longer fulfilled their active function and the grapes remained small and miserably drooping.

All the hybrids without exception were severely tried, particularly white and red Seibel, Baco, Malègue 1157-1 and Girerd 157.

As regards fungoid disease and scorching, it can be said that, as the season had been so dry, disease hardly appeared, and there was practically no mildew and just a few attacks of oidium. Though the direct bearers did not suffer in this respect, the same cannot be said of scorching, which affected practically all the vineyard, fairly severely in certain regions, and caused an appreciable loss of the crop.

The sudden heat on August 10 with + 52° C in the sun and on August 15 with 50° C, after a dull period, caused this damage to the uncovered bunches which were then in an awkward period of growth. The hybrids were severely tried because they themselves had no resistance.

489 – **The Behaviour of Certain Grafting-stock as regards the Great Drought of 1919, in the South of France.** — See No. 532 of this *Review*.

490 – **Effects of Summer Temperatures on the Geographical Distribution and Germinating Capacity of the Seeds of *Pinus sylvestris* in Sweden.** — See No. 536 of this *Review*.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

491 – **Calcium and Magnesium Content in Virgin and Cultivated Soils in Ohio.** — Ames, J. W. and Schollen-Berger, C. J. (Ohio Agricultural Experiment Station), in *Soil Science*, Vol. VIII, No. 4, pp. 323-335, bibliography of 8 works. Baltimore, 1919.

The authors have estimated the contents of total and N/5 nitric acid soluble calcium and magnesium as well as the carbonate and soil reaction of both cultivated and virgin soils in 23 localities in Ohio.

The analytical data show that, in the majority of virgin soils, there is a concentration of easily soluble calcium and magnesium near the surface, whilst, in cultivated soils, the subsoil contains more of these elements than the surface soil.

There are certain interesting relations between the proportion of the total soluble calcium and magnesium and the content of carbonate, as well as the soil reaction. Thus, when the proportion of the total soluble calcium and magnesium together, is relatively high, the soil often contains more carbonate and is more basic than similar soils containing a smaller proportion of soluble bases and this fact holds good for soils with a low percentage of carbonate as well as for those with a high percentage.

492 – **Absorption of Soil Constituents by Plants at Various Stages of Growth.** — BURD, J. S. (Professor of Agricultural Chemistry, College of Agriculture, University of California), in the *Journal of Agricultural Research*, Vol. XVIII, No. 2, pp. 51-72 + 1 Fig. + Bibliography of 9 works. Washington, D. C., 1919.

Experiments were made with Beldi selected barley grown on a silty clay loam and on a fine sandy loam respectively in 1916 and 1917, and the composition was analysed at various stages of growth.

In spite of the diversity of soil and harvest, a considerable parallelism was observed between vegetative growth and the successive changes of the rate of absorption of the plants. Thus, a large absorption was noted in the first stage, then a notable loss of potash and nitrogen in the plant in the second stage of growth ; then there is a fresh period of absorption, while, in the third stage, absorption practically ceases. The losses took place when the constituents of the aqueous extracts of the soil were at a minimum or close to it, and when the constituents migrated from the leaves to the ears.

The authors are of the opinion that a high concentration of the soil solution is unnecessary and is even undesirable at certain stages of the growth of many plants. They suggest that the research method followed with barley should be applied to other plants in the hope of obtaining data for the more rational formulation of experiments with sand and water cultures.

493 – **The Effects of Zinc in Experiments on Soils Contained in Zinc and Galvanised Iron Recipients.** — CONNER, S. T. (Dept. of Soils and Crops, Purdue University Agricultural Experiment Station, Lafayette, Ind.), in the *Journal of the American Society of Agronomy*, Vol. XII, No. 2, pp. 61-64 + Bibliography of 9 works. Washington, 1920.

During experiments with acid soils, in zinc and galvanised iron pots covered with paraffin wax, the crops in the second season unexpectedly decreased. On examining the literature on the subject, it was seen that zinc has usually a toxic action on crops and, in fact, the experimental soils were analysed and found to contain zinc in harmful quantities when they were not limed, while, in those that had been given plenty of lime the zinc content was appreciably reduced. Thus, the acid soils in the pots contained from 0.021 to 0.088 % of zinc according to the acidity, while, in limed and non-acid soils, the zinc varied between 0.001 and 0.002 %.

These results can be explained by the fact that the paraffin wax coating of the pots had a granular structure, so that the acids of the soil could pass through and form zinc salts. No really protective and efficacious covering has yet been found, and for this reason zinc should not be used with acid soils. The action of acid soils on the zinc shows that these soils really contain acids, i.e., their acidity is chemical and not physical owing to selective absorption.

494 – **The Use of War Explosives for Industrial and Agricultural Purposes.** — GARIBALDI, C., in the *Giornale di Chimica Industriale*, Year II, No. 1, pp. 10-22 + 9 Figs. Milan, 1920 (1).

Explosives which, owing to their chemical composition and their structure, burn rapidly and which, by their lively and instantaneous combustion,

(1) See *R.*, 1911, Nos. 2529, 3135 ; 1912, Nos. 671, 777, 1398 ; 1913, No. 230 ; 1914, No. 1092 ; 1917, Nos. 107, 1000 ; 1919, Nos. 19, 685, 821, 1091. (*Ed.*)

give off gases at high temperatures and produce considerable pressure, are usually considered as mining explosives, whose action is to split up by the explosion. Amongst the commonest ones, which have long been used industrially for piercing, demolishing and destroying heavy, cumbrous materials, for rectifying canals, work on mines, roads, etc., the different grades of dynamite and special black powders have so far taken first place. Several more or less successful attempts have been made to adapt these explosives to agricultural use.

In 1870, DE HAMM, at Vienna, suggested the use of dynamite in agriculture. In 1878, ASCANIO SOBRERO, the inventor of nitroglycerin, published in the *Annali della R. Accademia d'Agricoltura* of Turin, the results obtained by using dynamite for agricultural purposes and he also gave instructions to farmers in the use of this explosive for breaking up land. As various disadvantages became apparent, and as the process was not generally adopted at that time for various reasons, without counting the absolute need of special knowledge and skilled workmen, these experiments were not received with great interest in the agricultural world. Several years passed, during which these experiments, if not completely abandoned, were at any rate somewhat neglected, until the subject was bravely taken up again and applied on a large scale first in America, where an industry actually sprang up, and developed so that, in 1911, a single works in the United States sold 3 millon francs' worth of dynamite solely for breaking-up soil. Similar uses were tried in Europe, and Italy also followed this example. The use of dynamite and black powder, for felling trees, opening roads, excavating in rock and destroying bridges has always been peculiar to military services.

Up to the present, dynamite has always been the explosive used in agriculture, whilst the modern explosives brought forward by the recent war have only been used for military purposes. Now, there are huge stocks of them which cannot be utilised and which are easily subject to dangerous changes. New experiments have been made with these explosives, using past experience as a guide, and as these cannot be costly now, the object of the experiments was to help the farmer to carry out work that he could not accomplish solely by ordinary means.

The explosives that have been tested thus can be divided into three groups :—

1) Progressive firing explosives, using as a basis, nitroglycerin, balistite and solenite, in sheets, slabs or threads.

2) Trinitrotoluol (tritol, T. N. T.), which requires a detonator ; in crystals or granules, compressed or melted into blocks.

3) Trinitrophenol (picric acid), also requires a detonator ; in crystals or fused in blocks like T. N. T.

After having tested these new explosives destined for mines in their special use, and after having found that they could replace dynamite, which is now very expensive to make, the tests were turned to agricultural purposes, in order to find whether they could be used for breaking up so much land which henceforth need no longer remain uncultivated.

The first experiments were made on arid, compact, stony soil, which had never been worked and was capable of breaking the coulters and twisting the share of the best of ploughs.

Several holes, 70 cm. deep, were made in a plain of this nature and cartridges with 20 gm. of powdered T. N. T. were placed in each hole. The explosion reduced the soil to fragments within a diameter of 1.80 metres and more, and disturbed the soil all round in a circle of at least 50 cm. The soil was all broken up to a depth of 2 metres and signs of disturbance were found deeper still.

Dynamite and black powder do not behave as well in this soil as in hard rock, as they need compactness in order to develop all their strength.

After the way in which these explosives act in soil was ascertained, a large number of tests were made.

Sixty holes, 30 mm. in diameter and 40 cm. deep, were made, always in soil of the same nature, and 20 were charged with balistite, 20 with T. N. T. and 20 with picric acid, each in 100 gm. cartridges. The result was 60 holes full of broken soil, always most broken towards the bottom, the soil being as finely broken up as if it had been done by hand. Sixty other holes were loaded with the same explosives, in the same amounts and under similar conditions to the preceding ones, but at a depth of 60 cm. The explosions were not so loud and less soil was thrown up.

Further experiments were carried out with 60 mines loaded in the same way, but at a depth of 80 cm. The explosions were very dull and almost unnoticed, little or no soil was thrown up and while the cavity formed in the previous tests was shaped like a glass or cylinder, in this case all that was found was the surface soil cracked all over ; just below, however, there was a flask-shaped hole ending in a point at the bottom, as much as 1.20 metres deep, and with a diameter of about a metre, round which the soil had been much disturbed up to the surface, as in the previous cases. In this experiment, picric acid was found to be the best, as its action was felt over a wider zone than that of the other explosives. Whilst balistite, with slower combustion, had broken up the earth splendidly at a slight depth, the other more rapid explosives were better, when placed deeper down in a harder soil and with greater resistance to overcome.

The explosives tested gave different results in soil according to the depth at which they were placed, not so much on account of their chemical composition and mechanical action as of various physical factors amongst which the density is directly or indirectly of the greatest importance.

From the results showing the different behaviour of the explosives as regards the charge and the effects produced at different depths and under different conditions, the authors deduced accurate rules for working larger areas of land which previously had been left uncultivated owing to the great cost of bringing them under cultivation. For breaking up compact soils which will be used for growing herbaceous crops, for which the soil does not need to be moved to any great depth, balistite is the best explosive to use, because it does what is required of it over a larger cultivable area, while T. N. T. and picric acid are more suitable for such work as excavating

holes for planting trees. It should not be forgotten that all the above experiments were carried out in soils of the same nature. If the soil and the charges are varied, the same explosives will produce other types of broken-up land which are always less efficacious from the farming, standpoint, the more so as the soil becomes less tenacious, porous, light and less compact in type.

Again, if the holes are made at greater distances apart, up to 2 metres in every direction, and at a depth of 70 cm. with 100 gm. charges, the cones of soil left intact between the mines are bigger and have, in this case, a resistance that may cause trouble.

But if the rows of holes alternate, instead of being arranged parallel in squares, the volume of the cone is much reduced and, if the land has been mined with picric acid or T. N. T. (as these break up the soil very much at a certain depth, with the formation of flask-shaped holes), when the plough passes over these inverted cones, almost suspended in space, it then breaks them down and mixes them with the rest of the soil. Over a hectare of soil that was considered to be impossible to work, was mined in alternate rows on this system, and it is now completely cultivated, ploughed and ready to be sown.

It should be remembered that, in sloping ground, the explosion undoubtedly produces most effect if a fairly heavy charge is fired in the lowest range of mines, following it in the different rows with the normal charge; the direction should never be from the top rows to the bottom ones. In the first case, the explosion forms a chain of fairly pronounced ditches, and in any case the soil is shaken. The second row, finding the weak spot, explodes towards the first; similarly the third row explodes on the second and so on. In this way, the soil is mixed more intimately, and along the last row to be exploded, a furrow can be seen that might have been opened by a plough. This conformation can exist in flat land, but not to such an extent, as there is no slope to help in producing it. Again, in all soils, particularly those with slopes of varying steepness, the explosive is more effective according to the direction in which the mine points. Where there is a slope, the holes should never be made in a direction perpendicular to the horizon, but should always be inclined according to the slope of the soil. Even in flat land the holes should not be vertical but inclined to one side.

Experiments in damp, sandy soils of a softer nature are of no interest, as such soils can be worked by hand. In damp soils, T. N. T. and picric acid require special precautions, but if they are not exposed to these exceptional conditions for long, they act just as well as in damp soil. In soft soil, T. N. T. and picric acid only hollow out caverns, and even ordinary balistite is too energetic. It also also worth remembering that if the cavities produced by the explosion in hard, stony soils are surrounded by zones were the soil is extensively cracked (which assists the growth of tender roots and helps them to become vigorous, while enabling the excess water to drain away or the absorption of the water required by the plant), in soft soils, especially damp ones, the explosion projects particles of soil

from the centre of the zone of the explosion into the pores of the surrounding earth, thus producing a hard, compact wall with a smooth surface ; this physical condition is worse than the previous one.

Experiments carried out in the United States, in Australia, Malaya, Ceylon, Switzerland and England negative the hypothesis that land worked by means of explosives is poisoned and thus injurious to plant life. The lack of plant life on shell craters is no proof to the contrary, firstly because allowance must be made for the shock of the wave produced by the explosion of enormous charges on the ground and for the high temperature of the gases generated. At greater depths, and with time and the action of atmospheric agencies, only a minimum part of these gases can be absorbed by the soil and afterwards changed to salts, whilst the greater part escapes through cracks and openings into the air. Again, if vegetation wis absent or even scanty, it soon reappears and shows more vigour than ever. As regards the decomposition products of the explosives in question, they are of such a nature as to leave no room for doubt. Picric acid gives off carbon dioxide, carbon monoxide, hydrogen, methane and nitrogen ; T. N. T. gives off carbon dioxide, carbon monoxide, hydrogen and water, while the balistites and the powders based on nitroglycerin and nitrocellulose give off the same gases, with the exception of carbon monoxide.

From the economic point of view, the use of explosives for working hard, compact, rocky soils is generally the best, especially for work that does not require a general and continuous breaking up, whether on the surface or in the subsoil, but which needs a partial displacement of the soil, limited to narrow strips for ditches, small areas for plantations of trees, for absorbent wells, for removing tree stumps, etc.

Explosives, by lifting the soil within a certain radius and splitting up the layers in all directions, makes it easy for ploughs to continue in the following year, because they leave the soil porous and absorbent in its deepest parts and give life to abandoned and uncultivated areas by enriching the soil with a bumper crop the first year, thus giving it a value it had never had before. The economy due to the use of explosives, compared with the cost of tilling the ground with the usual implements, varies from 25 to 30 %, and if the ever-increasing cost of manual labour is taken into account, these figures can be increased by another 15 %.

In order to obtain good results from the use of explosives, it is absolutely essential that the person directing the work should know the best practical methods, while keeping in mind the results of previous experiments, as the quality and quantity of explosive and the method of preparation vary according to the nature and qualities of the soils and according to the objective desired.

So that the work can be done cheaply, improved apparatus is required and a number of detailed official regulations which might prevent continuous, profitable work should be altered so as to help agriculture. Again, the cost of the explosives should not be too high, as the cost of the work depends largely upon the help it affords.

In Italy, especially in the Roman Campagna, in Apulia, Calabria,

Tuscany, the province of Ferrara, etc., there are hundreds of thousands of acres of uncultivated land, which remain untilled simply because, with the available methods, the resulting profit would not cover the expense, and because the machines most adapted to the purpose would not give better results. Were these soils all cultivated, Italy would be self sufficient, as she would produce possibly more than her own needs, and as much money would not leave the country. Since the Italian Government actually possesses enormous quantities of explosives as war surplus, the author hopes that the experiments now being carried out in various regions of Italy for the benefit of agriculture will attract the attention of the Government, which ought to encourage and support the attempt to find the best solution of the question of using explosives for the benefit of farmers and the whole country.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION

495 - **The Problem of Drought in the North-East Region of Brazil and the Measures taken by the Brazilian Government.** — I. O problema das seccas no Nordeste Brasileiro, A meusagem do Sr. Presidente da Republica, *Republicas dos Estados Unidos do Brasil, Boletim do Ministerio das Relações Exteriores*, No. 3, pp. 59-62. Rio de Saneiro, September, 1919. — II. Id., A iniciativa do Governo para a sua solução, *Ibid.*, No. 6, pp. 59-60, December, 1919. — III. BRAGA, E., Seccas do Nordeste e Reorganização economica, p. 88. Rio de Janeiro, 1919 (1).

The rainfall in Brazil is very evenly distributed, for the greater part of its area constitutes a typical zone as regards humidity. An exception, however, is furnished by the north-east region which projects into the Atlantic and is somewhat distant from the coast. There we find a semi-arid zone surrounded by a semi-humid belt which stretches from the north of the State of Minas Geraes to Ceará. This zone is subject to intermittent drought, the cause of which is not so much the absolute lack of rain as its irregular distribution, and it corresponds to the trade-wind zone of the central Atlantic.

This problem was very carefully considered by the Brazilian Government after the great drought in 1877, which caused the loss of many human lives as well as large amounts of rural property. With the object of preventing harm from drought in this region, the Government, in 1909, set up an " Inspectorate of works against drought ", whose preliminary task was to study the problem from the physiographical point of view, not forgetting practical measures such as forest and forage crops, the construction of roads, reservoirs and dams, the provision of wells, fish-breeding, etc.

Without interfering with this plan, the Brazilian President, Dr. EPITACIO PESSOA, in a message quoted at the beginning of the article, considers

(1) See also : — DELGADO DE CARVALHO, C. M., Brazilian Meteorology, p. 528. London, 1917 ; MOREZ, H., Etat actuel de la météorologie agricole au Brésil ; *Review of Agricultural Information and Plant Diseases*, Year IV, No. 9, pp. 1356-1358. Rome, 1913 ; CRANDALL, R., and WILLIAM, H., Carta pluviometrica da Região semi-arida do Brasil. Rio de Janeiro, 1910 ; BORGHESANI, G. H. R. Planisfero udometrico dell'irrigazione. *Commissione Reale per studi e proposte relative ad opere di irrigazione, Seconda Relazione*, Part. III. Bergamo, 1916.

that, on the basis of the good results obtained in Egypt, India, and the United States, the reclamation of desert lands is equally possible for the area of Brazil in question, and that the public authorities should preferably pay attention to the conservation and utilisation of the water resources by means of large dams and reservoirs. The cost of this would obviously be enormous, but experiments made in other countries show that part of the cost could be recovered in a few years by the increased revenue from taxes, owing to the greater value of irrigated land and to the greater prosperity of the population. The fear that there would be insufficient water to feed the reservoirs in such a way as to make them really useful cannot be justified, as a lengthy study of the hydrometrical conditions in the state of Ceará, which is least favoured as regards this, revealed an annual precipitation of 80 milliard cu. metres, 16 milliards of which could be gathered and used for irrigating over a million hectares. For this reason, sanction is asked for the emission of a loan of 67 200 000 fr. a year (par value), until a total of 336 million fr. is reached. This money will be used for the construction and upkeep of large reservoirs of irrigation canals and supplementary works necessary for irrigating the cultivable soils in the north-eastern region of Brazil.

The Brazilian Congress has recently passed a decree authorising the creation of a special reserve to provide for necessary expenses as well as for the interest on and the amortisation of the loan mentioned above. The fund will be formed by :— *a*) 2 % of the general revenues of the Republic during the period required for carrying out the work ; *b*) 2-5 % of the ordinary revenues of each state interested, to be laid out, with the previous approval of the Federal Government, either in cash or in public lands ; *c*) the proceeds of the sale of land ceded by the states or of lands that could be expropriated ; *d*) the revenues from irrigation work ; *e*) contributions from any other source.

Land required as sites for irrigation works, inundated land and forests necessary for the conservation of watercourses will be considered as of public utility as regards expropriation.

The Federal Government will exploit and administer the irrigation works until the cost is fully repaid. Irrigation and maintenance taxes will be established as well as rent for the expropriated land. If the owners fail to cultivate their lands in accordance with rules laid down by the Government, such lands will be confiscated, as they will also be if no taxes are paid for 2 years. Again, when confiscated land is sold or let, preference will be given to the families of farmers who live in the state in whose territory the irrigated land is situated ; in any case only small areas will be ceded.

At the same time, the Government will attach agronomists and veterinary surgeons to the agricultural services of the area in question and will provide the farmers, either by loan or by sale, with the tools, seeds, fertilisers and everything needed for improving the fertility of the soil and to preserve, utilise, transport and market its products.

M. C. Braga, a Federal Deputy, showed, in a statement made before the Finance Commission of the Brazilian National Congress, that stock

rearing offers better prospects of success in north-eastern Brazil than cotton growing and irrigated crops. He estimates that one irrigated hectare under cotton, yields 12 quintals of cotton worth about 900 fr., whilst one hectare down to pasture for fattening stock will yield 850 fr.; this slight difference is more than compensated for by the manuring of the soil, by the smaller risk and by a lower cost.

On account of the great irregularity of the rainfall, shown by the following table: —

Rainfall in four typical localities.

	I	II	III	IV
1904	1 265 mm	230 mm	456 mm	1 134 mm
1905	1 467	463	383	1 131
1906	1 773	487	737	1 579
1907	837	245	391	715
Yearly averages	**1 280 mm**	**375 mm**	**456 mm**	**1 123 mm**

M. Braga considers that the transport question is of immediate importance and that a suitable network of railways and carriage roads would, in years of drought, enable the population to emigrate from one zone of a region to another with more abundant rainfall, so that the 30 million inhabitants and the livestock of north-eastern Brazil would, if they desired, have a possible outlet towards the large irrigation centres suitably distributed over the country. As no great irrigation scheme is exclusively based, with a few exceptions, on rainfall, but rather on water derived from permanent rivers, and considering constructional difficulties M. Braga thinks that it would be best to construct the three largest reservoirs for each of the three States that suffer most from drought, viz., Ceará, Rio Grande do Norte, and Parahyba, and if they give good cultural and social results, there would be no reason to prevent their extension and development.

496 – **Irrigation of Field Crops: Experiments in Nevada, U. S. A.** — Knight, C. S. and Hardman, C., in *Bulletin* No. 96, *Agricultural Experiment Station, University of Nevada*, pp. 42, 20 Figs. Carson City, Nevada, 1919.

Discussion of the methods of irrigation used in Nevada; water supply and area irrigated by the State; factors affecting the results of irrigation water; description of experiments on irrigated field crops including alfalfa, wheat, potatoes, red clover and sugar beet.

In 1918, 900 000 acres or about 1.3 % of the area of Nevada was irrigated, and produced approximately some 145 000 acres of alfalfa, 80 000 acres of wheat and 15 000 acres of potatoes. The chief rivers that supply irrigation water are the Humboldt, Truckee, Carson, Walker, and Muddy; the Humboldt waters over half the total irrigated area.

Most of the alfalfa and cereals acreage is irrigated by flooding, while potatoes and other hoed crops are irrigated by means of irrigation furrows.

The chief factors that influence the effect of the irrigation water are the type of soil, its topography, the presence of a crust near the surface, the annual rainfall, and evaporation. The soil type causes more variation in the quantity of water required for irrigation than any other factor.

The average results of the experiments made with alfalfa during the period 1906-1911 show that with a total consumption of 3.27 acre feet of irrigation water, a yield of 5.93 tons of hay per acre is obtained. In the 5-year period 1914-1918, there was not sufficient rainfall during the growth period to influence the soil-moisture content of the soil. When irrigation was delayed until the alfalfa began to wither, the unit yield was relatively low; there was, however, a very high yield when irrigation was practised when the plants had only assumed a dark colour. The most economic irrigation for alfalfa was accomplished with a total irrigation of 3.5 ft., of water, each time the plants showed need of water by turning dark green in colour.

Soil moisture determinations showed that, with an irrigation of 6 in, of water, 70 % of it was retained in the first 4 ft., of soil; but with this, the lowest crop per unit volume of water consumed was obtained, or 6.18 tons of hay per acre for a 81 in., layer of water. Soil moisture determinations also showed that only 25 % of a layer of 12 in., of water was retained by a surface layer of soil 4 ft., deep. In irrigated alfalfa fields, the decrease of the soil moisture content at mowing time was generally greater when 9 and 12 in., of water were given, while the total quantity of irrigation water retained in the soil was greatest at the time of the two last periods of wilting.

In experiments made with wheat during the 5-year period 1914-1918, 3 and 7 in., was given during two or more of the typical growth periods, i. e., appearance of the fifth leaf, ear formation, flowering, milky consistency of the grains, pasty consistency. The maximum yield was obtained with 28 in., of water in four applications, omitting that of the period when the fifth leaf appeared. The maximum yield with 3 irrigations was obtained with 21 in., of water, omitting the irrigations given during the first and last of the above-mentioned 5 periods. The average yields of wheat were considerably higher when 7 in., of water was given than with 3 in., at each irrigation. The yields were relatively low when the irrigations of the ear-formation and flowering periods were omitted, which shows a very critical period for wheat as regards its need for water, between ear formation and the period when the seeds are of a milky consistency. The highest yield was obtained by giving 9 in.. of water in 2 irrigations, one before and one after earing. High unit yields were usually accompanied by the greatest decrease in the soil moisture content at harvest time compared with the soil moisture content before the first irrigation.

In the experiments with potatoes, continued during the 4-year period 1914-1917, the heaviest crop was obtained with a total irrigation of 16.5 in.,

of water, distributed in 3 in., applications when the plants showed a tendency to wilt.

Irrigation experiments with clover showed a gradual decrease in yield in as the wilting period of the plants advanced at the time of irrigation.

Sugar beets gave the heaviest crop with 18 in., of water in 3 in., applications.

The results show, generally speaking that the most economical use of water consisted in giving a total of 3.5 ft., at the rate of 6 in., per time for alfalfa and clover ; with a total of 2.3 ft., in 3 in., a time for application for wheat with a total of 1.5 ft., in 3 in., applications for potatoes and sugar beets. When alfalfa is used for autumn pasture after the last mowing, usually an extra irrigation is required after the last harvest.

MANURES AND MANURING

497 – **The Preservation of Liquid Manure.** — KRISTENSEN, R. K., in the *Tidsckrift for Planteavl*, Vol. XXVI, Pt. 3, pp. 485-490. Copenhagen, 1919.

The Danish State Agricultural Experiment Station at Askov has carried out experiments on the preservation of liquid manure by adding sulphuric acid or superphosphate.

The liquid manure used contained 0.478 % of nitrogen, of which 0.418 % was present as ammonia. It was placed in porcelain dishes and evaporated on a water-bath ; a series of 5 cc. samples was treated with from 0 to 32.5 cc. of decinormal sulphuric acid and with from 0.1 to 1.5 gm. of 18 % superphosphate.

The results obtained showed that two-thirds of the acid used was retained by the ammonia, and the rest by the other bases. Very small quantities of acid had practically no effect on the conservation of the ammonia ; in order to fix all that contained in the 5 cc. sample, 1.3 gm. of superphosphate or 22.5 cc. of decinormal sulphuric acid was required.

498 – **Experiments and Researches on "Tetraphosphate".** — MENOZZI, A., in the *Giornale di Chimica Industriale*, Year II, No. 1, pp. 8-9. Milan, January, 1920 (1).

Some four years ago, a product called "tetraphosphate", made and marketed by a company bearing the same name, gave rise to a large number of publications and to much discussion, Publications in its favour upheld and still uphold that it has the same fertilising value as superphosphate, but without the acidity of that product which is so injurious to certain soils and harmful to the bags, and that it provides phosphoric acid at a cheaper rate than superphosphate.

After a chemical and petrographical examination of a few samples the author, in a public lecture given in May, 1916, at the Higher School of Agriculture at Milan, expressed the opinion that it is substantially nothing else than phosphorite. This announcement led to discussion even at the lecture ; interested persons held that the samples sent to the laboratory were probably not indentical with the commercial product, that i

(1) See *R.*, 1916, No. 1063. (*Ed.*)

was not purely a question of phosphatite, but of phosphorite radically changed by tratment, and that, in addition, practical tests had given results favourable to the new product. The representatives and manufacturers of superphosphate then suggested that a commission, presided over by the author, should study the product in detail by means of cultural tests. The representatives of the tetraphosphate company accepted the proposal and the commission was set up. It has now published a report on its work and on the cultural tests carried out during 1916-17 and 1917-18. A summary of the report is given below.

In accordance with the plan decided on, the commission saw the actual preparation of the product which, according to the patent specification, consists essentially in mixing ground phosphorite with 6 % of a mixture, known as the " reagent ", composed of calcium and magnesium carbonates, sodium sulphate and carbonate ; the whole mixture is heated in a furnace and the mass while still hot is hydrated. The process took place in a special plant belonging to the superphosphate factory of the co-operative agricultural consortium of Lodi (Milan).

The commission took samples of the phosphorite and of the mixture of phosphorite and reagent before heating and of the product obtained after heating and hydration ; these samples were examined chemically and petrographically, in the latter case by Prof. ARTINI, director of the municipal museum of Milan. The results of both the chemical and petrographical examinations showed that no chemical or structural change had taken place in the raw material (phosphorite,) during heating and subsequent hydration, under the conditions of manufacture as seen by the commission. Neglecting the salts added in the " reagent ", the original phosphorite was still to be found.

In spite of this, the commisslon, admitting that some fact might have escaped notice and wishing to neglect nothing, decided to make comparative experiments in pots, boxes and in the field, with different plants and soils. The report gives full details of thse experiments and here it may simply be said that, in each test, with the same plant and the same soil, the same potassic and nitrogenous fertilisers were given in equal amounts, and that comparisons were made between the different phosphatic fertilisers, i. e., phosphorite, tetraphosphate, and superphosphate, which were given in such a way as to contain equal amounts of phosphoric acid and in a pot or plot, the same treatment with nitrogen and potash, save that no phosphatic fertiliser was given.

The fineness of division of the tetraphosphate compared with that of superphosphate was examined, but only negligible differences were found on carrying out laevigation.

None of the tests made in 1916-1917 gave positive results, for not only were the differences between the various phosphatic fertilisers slight, but they were also slight between the pots with phosphatic fertilisers and those without phosphates and, in one experiment, the control produced more than the pots or plots given fertilisers. This may possibly be due to the fact that, on analyses, carried out during the tests and not previous to them (in

order to save time), the soils used were found to be all relatively rich in phosphoric acid, viz., from 1.25- 2.20 per 1000 of soil. Therefore, definite conclusions cannot be drawn from these tests.

On the contrary, however, significant results were obtained in 1917-1918, in which year several tests had to be discarded, because, in one case, the crop was ruined by hail and in others because the crops were damaged by parasites. But all the other tests were completed without hindrance, and definite conclusions can be drawn. The yields obtained in 1917-18 show that : - - phosphorite and tetraphosphate always produced a little more than the control with phosphatic fertiliser; that both were always inferior to superphosphate ; that there were only slight differences between phosphorite and tetraphosphate, and these mostly came within the limits of experimental error.

499 – **Fertilising Value of "Broom Millet". Ash** — Guthrie, F. B., in the *Agricultural Gazette of New South Wales*, Vol. XXX, Pt. 10, p. 735. Sydney, 1919.

The ash of broom millet is comparatively rich in potash and, with the present price of 15 *s.* per unit of potash, a ton of the ash is worth about £. 11, though, under normal conditions, this figure would only be about £. 3.15*s*. It should not be forgotten, however, that the ash contains about 4.5 % of phosphoric acid.

Analysis of sagine ash.

Moisture	2.59 %	Potash	15.53 %
Insoluble	57.23	Soda	1.07
Oxide of iron and alumina	3.73	Phosphoric acid	4.67
Lime	6.11	Sulphuric anhidride	2.46
Magnesia	3.53	Carbonic acid	2.40
		Chlorine	0.77

500 – **Sulphur as a Fertiliser.** — Söderbaum, H. G., in *Kungl. Landtbruks Akademiens Handlingar och Tidskrift*, Year LVIII, No. 6, pp. 357-363. Linköping, 1919.

The author reviews the literature dealing with sulphur as a fertiliser and gives the results of his experiments. These were carried out with finely ground stick sulphur, using 16 glass jars containing 24 kg. of soil, growing oats from May 5 to August 11, 1919. The jars were divided into 4 series of 4 jars. The following yields were obtained :

	Crop			Weight of 1000 grains	Ratio Straw : Grain
	Total	Grain	Straw		
	gm.	gm.	gm.	gm.	
Series I (without sulphur)	60.2	26.3	33.9	34.2	1.288
» II (1 gm. of sulphur per jar)	62.1	26.4	35.7	36.5	1.352
» III (2 gm. per jar)	59.2	24.9	34.3	35.6	1.377
» IV (5 gm. » »)	62.4	27.6	34.8	36.1	1.260

The greatest differences found do not amount to double the probable error, whilst, in order to obtain safe data, they should be treble, without considering that the differences are not all of the same sign.

501 – **Papilionaceae in the Mostaganem Sands, Algeria.** — MANQUENÉ, J., in the *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord*, Vol. X, No. 3, pp. 66-69. Algiers, March 15, 1919.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

The various researches on the root nodules of leguminous plants have led to the general conclusion that root nodules are to be found mainly on Leguminoseae growing in poor soils.

There are exceptions to this rule, as the author found in the environment in which he has investigated the Papilionaceae for four years. This is the case with particularly poor sands that have been formed from astien gritstones (upper Pliocene) and which occur on the Mostaganem littoral.

From his researches he has deduced the following conclusions:

1) Papilionaceae growing in *poor, dry*, sandy soils, have no root nodules; those of *rich soils*, whether wild or cultivated, bear root nodules.

2) Bacterial symbiosis may occur in poor soils if there is sufficient moisture. However, under these conditions many Paplionaceae still have no root nodules.

3) Moisture favours nodule formation to the greatest degree. *Very dry* soils, no matter what their physical or chemical composition may be, are unsuitable for the growth of nodules on Papilionaceae.

4) In general, no nodules are formed on a papilionaceous plant growing under unfavourable conditions of nutrition.

5) The structure of the root influences the intervention of the bacteria, for nodules are always most numerous on roots with well developed cortical layers.

6) The presence of root nodules is apparently related to the area of the aerial assimilating surfaces of the plant.

7) Nitrate of soda does not prevent nodule formation in the Papilionaceae (*Faba, Cicer, Trifolium*);

502 – **Contribution to the Study of the Immediate Composition of Maize Seeds.** — PASSERINI, N., in the *Bollettino della Società italiana per lo studio dell'alimentazione*, Vol. I, Nos. 1-3, pp. 17-30, Florence, 1919.

Large numbers of analyses of maize seeds have been made. Some workers say they are very rich in total nitrogen, as for example PASQUALINI, who found as much as 11.6 % of nitrogenous matter in Italian maize, BOUSSINGAULT, who found 12.8 %, and PORTELE, who found 14.2 % in the "Cinquantain de Hongrie". But most analyses show a much lower content of from 7 to 11 % in seeds containing 12 to 14 % of water.

A fresh series of analyses was carried out by the author on Italian and American maize; the results, shown in the appended table, prove that maize is one of the poorest food cereals as regards protein content, as the total nitrogen content varied between 0.979 and 2.120 %,

with an average of 1.606 %. The maximum percentage was contained by an American maize specially selected for increased nitrogen content. When grown at Fauglia (province of Pisa, Italy), this maize retained, at least during 2 consecutive years, a higher nitrogen content than any of the other samples analysed; thus the percentage underwent a decrease that was greater in the first year of reproduction in Italy than in the second.

Amongst maize varieties rich in nitrogen, the author mentions *Zea rostrata* or toothed maize which, when grown in Italy, contains 2.088 % of total nitrogen.

	Nitrogen soluble in alcohol		
	Flour	Semolina	Bran
Maize from Scandicci (Florence)	0.487 %	0.731 %	0.383 %
Maize from Lorenzana (Pisa)	0.505 »	0.679 »	—

Analyses of maize grown or consumed in Italy.

Maize (whole flour)	Weight of 100 whole grains in gm.	Actual composition %								Total nitrogen %	Amino nitrogen %	Nitrogen in crude zein %	Ammoniacal nitrogen in the hydrolic liquid %	Nitrogen not hydrolisable by 20 % sulphuric acid
		Water	Crude protein	Fat (ether extract)	Starch	Pentoses (like arabinose)	Pentosans (= pentoses × 0,88)	Fibre	Ash					
Native red from Lorenzana . . .	—	12.667	8.525	6.140	56.250	2.222	1.955	1.850	1.483	1.364	0.979	0.643	0.288	0.097
American (selected)	33	13.260	13.250	4.420	56.748	2.778	2.445	2.240	1.400	2.120	1.721	0.942	0.300	0.099
Do-first year seed .	29	12.926	9.644	4.070	61.071	1.904	1.675	2.090	1.358	1.543	1.291	0.723	0.215	0.037
Do-second year seed	30	14.190	11.925	4.080	58.296	2.222	1.955	2.780	1.496	1.908	1.519	0.893	0.318	0.071
Pernambuco red .	29	13.366	10.600	3.420	58.828	2.000	1.760	1.510	1.476	1.696	1.395	0.643	0.247	0.054
Rio de Janeiro red.	29	12.440	9.275	3.520	58.828	2.631	2.315	1.655	1.438	1.484	1.184	0.571	0.230	0.070
S. Paulo white . .	40	12.490	8.275	3.530	65.434	2.333	2.053	1.495	1.450	1.324	1.023	0.643	0.247	0.054
Bergama white . .	31	13.838	8.831	4.610	62.867	2.222	1.955	2.060	1.368	1.413	1.182	0.500	0.177	0.054
Averages . . .	—	**13.147**	**10.041**	**4.224**	**59.790**	**2.289**	**2.016**	**1.860**	**1433**	**1.606**	**1.287**	**0.695**	**0.252**	**0.067**
Averages obtained on including the results of 16 previous analyses .	—	13.281	—	4.556	61.698	—	—	—	—	1.292	—	—	—	—

On calculating the average when including the data from 16 other analyses carried out by the author (*Atti della R. Accademia dei Georgofili* Series V, Vol. XI, 1914, the total nitrogen works out at 1.292 %. The nitrogen of the crude zein (soluble in alcohol) represents on an average about two fifths of the total nitrogen though it is almost half in some samples.

On screening, whole maize flour separates into fine flour, semolina, and bran consisting of the remains of the husk. The semolina contains the highest percentage of crude zein, as is shown in the adjoining table :

503 – **On the Composition of Sorghum.** — WILLAMAN, J. J., WEST, R. M., SPRIESTERSBACH, D. O. and HOLM, G. E., in the *Journal of Agricultural Research*, Vol. XVIII, No. 1, pp. 1-31, 18 diagrams, bibliography of 22 publications. Washington, October 1, 1919.

In 1877, the U. S. Department of Agriculture undertook a study of sorghum (*Sorghum vulgare*) as a sugar plant. Since then thousands of analyses of the juice of different varieties of sorghum have been made and published. Thus, well defined knowledge is available on the qualities and quantities of sugar present in sorghum juice, particularly in the sorghums grown in the temperate zone of the United States. In some papers, the effect of heading on the composition of the juice has been studied, while in others studies have been made of the technique of the preparation of sorghum syrup. But when Mr. WEST (one of the authors) began to give a better economic and scientific basis to the sorghum sugar industry in Minnesota in 1912, the need for further research became apparent : as regards the effect of climatic factors on the composition of the cane, more exact knowledge was needed concerning the behaviour of sorghum brought to the north in the most northerly limits of its zone ; 2) in order to lengthen the crushing season as much as possible, the cane ought to be used just before it is ripe and quite often after the death of canes killed by frost ; 3) the methods of purification and evaporation commonly used needed improvement and standardisation ; 4) for economic reasons, the small sorghum sugar works, with inefficient mills, where little or no purification took place and where evaporation was slow, should be replaced by the large mill, otherwise the fall observed in the production of sorghum syrup during the last 30 years would continue. Data of practical as well of scientific interest have been obtained by researches on this subject at the Minnesota Agricultural Experiment Station. The latter have been collected in *Bulletin* 187 of that Station, whilst the former are summarised in this abstract.

Three varieties of sorghum — Minnesota Early Amber, Early Rose, Dakota Amber — were chosen in order to study the progressive growth of the plant and the chemical composition of its different parts.

During one season, a determination was made of the relative proportion of weight of leaves, panicles and stripped cane in the freshly cut plant and in the partially dried plant. In the whole plant, the dry matter was continually on the increase up to maturity. The content of crude fibre decreases in a proportion practically equal to that of the increase of soluble carbohydrates, and the percentage of crude fat, ash and protein

remains practically constant for all the periods of growth observed. When the total quantities of each constituent present in the plant at the different period of growth are calculated, it can be seen that the plant builds up its cell structure of cellulose, protein and mineral matter during the first part of its growth period, and that the subsequent periods of growth consist in the filling up of these tissues by carbohydrates (starch in the seeds and sugar in the stems). No data were found that tended to show that the leaves give up their carbohydrates to the stem. The food value of the leaves is greater the older the plant.

The maturation of the panicles consists almost entirely in the filling up of a skeleton of cellulose and protein by starch. There is a considerable accumulation of mineral matter in the leaves, probably due to lime and silica. When an equal volume of alcohol is added to the juice expressed from the canes, a precipitate is obtained consisting of three parts : — 1) proteins ; suspended cellular matter derived from the crushing of the fibre in the mills ; 3) true gums : the gums are masses of galactanes and pentosans with about 20 % of mineral matter, especially lime magnesia and potash. The organic acids found in sorghum are aconitic, malic, citric, tartaric and oxalic acids.

The amido-nitrogen is present in high proportions in the juice of sorghum as well as in the ripe cane. This constitutes an important factor amongst the causes of difficulty of purifying sorghum juice for the production of syrup or sugar. The following nitrogenous substances have been found in sorghum juice : — l-leucine ; d-l-asparagine ; glutamine ; cystine (?) ; aspartic acid.

The juice of the secondary stems is similar in composition to that of juice from the main stem during the same period of ripening. However, the maturation of the secondary stems is usually 3 weeks later than that of the main stem. The middle nodes of the stem, compared with the upper and lower nodes, contain more saccharose and total sugar, but less dextrose and laevulose. The upper nodes contain so little sugar and their juice has such an extremely low coefficient of purity that it is advisable to exclude them from the crushing when preparing syrup.

The stems of sorghum growing in Minnesota contain a much lower percentage of sugar than that in sorghum growing in regions with a longer and warmer growth period. Several observations make it probable that if the onset of frost could be retarded, the proportion of saccharose and reducing sugars in sorghums usually considered to be ripe would rise during 7 or 10 days and a larger quantity of total sugars would be elaborated. The juice of sorghums growing in the northern zone is of greater purity than the juice of sorghums growing in the southern zone. It is a phenomenon of precocious ripening that shows in most plants grown under suboptimum conditions : at the period when the panicle first appears, the reducing sugars are in excess over the saccharose. Afterwards the reducing sugars rapidly decrease, while the saccharose increases until the moment when in the period of complete flowering, they are present in almost equal

quantities. The respective changes continue until maturity is reached. At this moment, the ratio between saccharose and reducing sugars is about 70 : 30 in sorghum grown in Minnesota. In very ripe sorghum from Virginia, the ratio is 90 : 10 and even higher. The removal of the panicles before maturity of the seeds hastens on the production of the maximum of sugar in the juice, but this maximum would be reached later on without heading the plants.

504 – **The Essence of Mustard in Plants.** — Cauda, A., in *Le Stazioni sperimentali agrarie italiane*, vol. LII, parts. 10-21, pp. 544-548. Modena, 1919.

Mustard essence (allyl iso-sulpho cyanide) is contained not only in various species of *Sinapio*, but also in numbers of other species — for example : *Cheiranthius Cheiri* — *Lepidium Draba* — *Bassica Napus* — *Raphanus Raphanistrum* — *Sisymbrium Alliaria* — *Nasturtium officinale* — *Lepidum sativum* — *Cochlearia Armoracia* — *Reseda lutea* — *Reseda luteola* — *Capparis spinosa* — various species of *Acacia* — *Thlaspi arvense* — *Asparagus officinale* — and various species of *Erysimum*.

Work carried out by the author shows that in a general way, seeds from southern climates have a lower percentage of essence content than seeds from a northern climate. This confirms the statement that the quantity is greatest where vegetation is less developed. This fact is due to the incomplete transformation of the chief plant albuminoids, which are not entirely assimilated and remain as reserve matter in the vegetable tissues.

The samples of mustard from Piemonte and Forlí with very small seeds (perhaps wild) contain on the whole a larger quantity of essence thant the samples of seed from other districts, for example Sicily, where this plan is cultivated in the ordinary way. It appears then that cultivation favours plant development, but decreases the essence content. An intimate relation exists between the essence content and the percentage of fats ; if the percentage is raised the essence content is lowered. Mustard seed from plants cultivated in warm climates are richer in oil but poorer in essence content.

Mustard oil is found in varying proportions but always fairly high : *Sinapis alba* 33 % — *S. nigra* 25 % — *S. arvensis* 30 %. This percentage varies according to the climatic conditions : *Brassica juncea* of Eritrea contains 40 % oil, and the Indian mustards 47.21 %.

The principal active enzyme of the Cruciferae is contained in special cells, very refractive to light, and exposed to view by the Millon reagent — cells which Heinricher, through erroneous interpretation called " Eiweisschläuche " or albumin reserves. By means of different preparations of leaves or seeds, the author has traced the presence of such cells, and their number and size tend to diminish in the case of etiolated leaves.

According to Naegeli (*Theorie der Gärung* p. 14) during seed germination, the potassium myronate splits up with the formation of mustard essence. By analyses of seeds and young green shoots, and etiolated shoots, the author states that the quantity of essence remains almost constant during the germinating period, but considerably decreases in the case of

young etiolated shoots. In seeds of Black Mustard (Salemi) : about 0.294 % was found; in young green shoots (air-dried) 0,280 %; in young etiolated shoots (air-dried) 0,170 %.

505 – **The Effect of Nitrogen Fixing Organisms and Nucleic Acid Derivatives on Plant Growth.** — BOTTOMLEY., W. B., in the *Proceedings of the Royal Society*. Serie B. Vol. 91, No. *B*-636. Biological Science, p'. 83 to 95. London, Jan. 1, 1920.

In a previous communication (*Proceedings of the Royal Society* Series B. Vol. LXXXIX, pp. 481-507, 1917) it has been shown by the author that a water extract of bacterised peat has a remarkable effect on the growth of *Lemna minor* in water culture solution, and that wheat seedlings when deprived of their endosperm at a very early stage, will not grow naturally unless supplied with a small quantity of organic matter.

A growth of *Azotobacter chroococcum* was obtained sterilised, and then transferred to a beaker with some distilled water, and heated on a water bath, when cold DETMER'S solution and distilled water were added to make up the required volume for use with *Lemna minor*. After 6 weeks, it was evident that the addition of the sterilised *Azotobacter chroococcum* to the culture solution, not only resulted in an increased rate of multiplication of the *Lemna* plants, but also enabled them to increase their original size, while the weight of control plants showed a corresponding decrease. Similar results were obtained with *Bacillus radicicola*. Extracts known as "crude nucleic acid derivatives from raw peat", and "adenine-uracil dinucleotide from raw peat" both had a similar effect on development.

When the extract of "crude nucleic acid derivatives were administered to the same plants and at the same time as the growths of *Azotobacter chroococcum*, the combined growth promoting effect was far greater than the sum of their effects when added separately. This shows that the stimulating constituents in the extract of bacterised peat differs from those in *A. chroococcum* Neither the ash of the nucleic acid derivatives nor the *A. chroococcum* had the slightest effect on growth. and the beneficial results following the addition of these materials can only be attributed to the organic constituents.

PLANT BREEDING

506 – **Possibility of an Intranuclear Cross in Homozygotes.** — LOISY. J. P., in *Genetica Nederlandsch Tijdschrift voor Erfelijkheids en Afstammingsleer*, Vol. I, Part I, pp. 92-97. La Haye, Jan. 1919.

As a result of the studies by MORGAN, it is a recognised fact that even in the nuclei haploids, chromosomes may be present in various forms and dimensions, which make crossing possible (between chromosomes) even in homozygotes.

This cross cannot take place during the synapsis phase. In a homozygote, with 3 different chromosome types, the synapsis appears as shown in Fig. I. The small black, white and shaded discs represent the chromatomeres the constituent of various chromosomes. One haploid has 18 chromatomeres and another, 36.

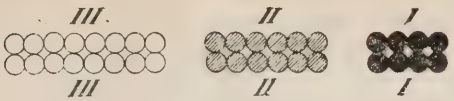


Fig. 1.

Although, in consequence of the division by reduction, the changes between the two homologous chromosomes may be possible, the nuclei gametes will always remain necessarily identical.

The crossing of chromosomes is not then possible during the synapsis period, but it can take place during the spiral phase when the chromosomes unite end to end and make a single line or a small crown composed simply of chromatomeres (fig. 2).

Fig. 2.

Usually, in the following phase, when the chromatomeres acquire their new individuality, the division of the elements rights itself at the points of union in such a way that their constitution remains unaltered (fig. 3).

Fig. 3.

This is the general rule. Let us suppose besides, that a chrome from chromosome II may fuse with chromosome V; let us suppose still further, that the division, instead of taking place at the points of contact, is displaced slightly toward chromosome II; in this case we should have an arrangement as in fig. 4.

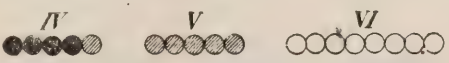


Fig. 4.

Chromosome I with a chromatomere from chromosome II becomes chromosome IV. Chromosome II in its turn, becomes chromosome V with 4 chromatomeres only, instead of 5, whilst chromosome III although unaltered, will become in time, owing to its symmetry, chromosome VI.

Let us suppose now that a gamete, with chromosomes I. II, III, IV, V

and VI, may become united to a normal gamete with chromosomes I, II and III. An individual would be obtained which according to the arrangement of the chromosomes, is a hybrid, but, which, in possession regularly of 36 chromes, would not be easily distinguishable from the corresponding and absolutely normal homozygote represented in Fig. I. If should however be considered as a homozygote in the zygotes from which, at the moment of synapsis it will be changed into as many pairs of chromosomes as under normal conditions, but from which the following 8 gametes will be obtained:

I, II, III	I, II, VI	I, V, III	I, V, VI
IV, V, VI	IV, V, III	IV, II, VI	IV, II, III

Amongst these 8 gametes, the gametes I, II III and IV, V, VI are identical to those from which the individual is derived.

The gamete formed by chromosomes III and VI is identical to that formed by chromosomes III and III, being given that VI = III.

The gamete with chromosomes IV. V and III is identical to that which is constituted by chromosomes IV. V and VI, being given that III = IV.

The gamete with chromosomes I. V and III is identical to the gamete with chromosomes I. V and VI, being given that III = IV.

The gamete with chromosomes IV. II and VI will be identical to the chromosomes IV. II and III, being given always that VI = III.

There are therefore now only 3 gametes to consider: I. V. III and IV. III. VI — The former possesses a lower chromatomere (= 17) (fig. 5) and the latter a higher chromatomere (= 19) (fig. 6).

Fig. 5.

Fig. 6.

By the fusion of 2 gametes, type I. V. VI, a loss mutant or "Verlust-mutant" would be derived, and by the fusion of gametes; type IV. II. VI: a "progressive mutant", i. e. + the new chromatomeres.

What will happen when a cross is made between these mutants and the original:

Fig. 7.

In the case of the loss mutant, an individual would be obtained after uniting with the original, with a composition as shown in Fig. 7 and from this 8 gametes would originate.

A	with	chromosomes	I, II, III							
B	»	»	I, V, VI							
C	»	»	I, II, VI	=	A	being	given	that	VI	= III
D	»	»	I, V, III	=	B	»	»	»	III	= VI
E	»	»	I, V, III	=	B	»	»	»	III	= VI
F	»	»	I, II, VI	=	A	»	»	»	VI	= III
G	»	»	I, V, VI	=	B					
H	»	»	I, II, III	=	A					

Fig. 8. shows that 64 combinations are possible. Records of 16 AA ; 32 AB : 16 BB are given following the scheme 1 : 2 : 1 of a mendelian monohybrid. It can however be concluded that, by uniting a homozygote normal type gamete with a gamete which as a result of an exchange of elements between chromosomes, has lost a chrome, the phenomena of segregation of characters following the Mendelian scheme for a monohybrid, would be obtained in F^2.

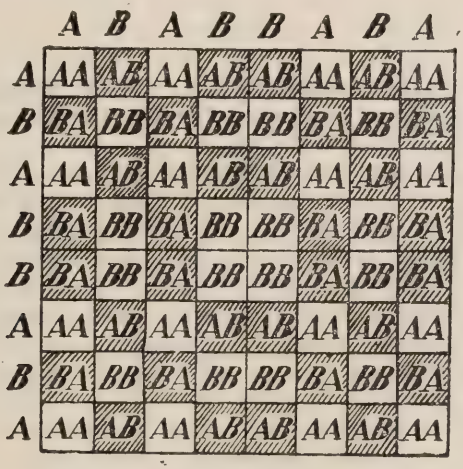


Fig. 8.

What will happen when a cross is made between a gamete of a progressive mutant and a gamete of a normal homozygote ? In the zygote from which the individual sprang, the synapsis will give pairs as indicated in Fig. 9. As in the preceding case, the two components can be distinguished only by one chromosome ; the pair I. V takes the place here of the pair II. V, but the result is always the same, with a segregation of characters in F_2, following the mendelian scheme of a monohybrid.

Fig. 9.

The progressive mutant studied by the author differs from the progressive mutant (De Vries) only because here the formation of a new determinative is not stated, but the simple halving of a chromatomere.

In any case, it is obvious that by a "cross between chromosomes" even in homozygotes, can originate from mutation loss and even from forms which do not differ from De Vries progressive mutants. It can be concluded that *all the "mutations" met with in pure lines can be explained by the phenomena of the cross between chromosomes".*

This is naturally only the case with sexual reproduction. Considering two plants which reproduce asexually, the exchange of elements between chromosomes is possible even in the haploid. The total number of chromosomes remains, however, unaltered under all circumstances, and the production of mutants is not possible.

In order to obtain the latter, a further cross between the gametes is necessary. Therefore : *for the formation of the "mutant" not only a cross between chromosomes is necessary, but also a successive cross between individuals.*

507 - **Improvement of Ligowo Oats by Crossing with Brie Oats and by Selection.** — Schribaux, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 6, pp. 113-122. Paris, 11 Feb. 1920.

The authors' object is to publish the names of the four new varieties of oats with high yields, obtained at the Experimental Seed Station, by crossing the black Brie oat with the white Ligowo oat.

The black Brie oat belongs to a type of oats of high quality. In this variety, not only the glumes are fine, but they open more or less readily when thrashed. As a result of the quality of the husk, the grain which would have been swallowed without mastication, instead becomes easily impregnated with digestive sugars, favourable to digestion.

The Brie oat, an essentially French variety, possesses an exceptional adaptability to the climate in the North of France.

On the other hand, there are obvious disadvantages :

(2) it is a late cropper, which means it is exposed to heat during particularly dry seasons.

(3) it is loose glumed ; it is necessary therefore to crop when still green in order not to loss the finest grains.

The *Ligowo oat* is probably the most widely cultivated variety to-day in the intensive culture district ; it should be mentioned that its popularity somewhat diminished after the introduction of Victoire (Seger) and Pluie d'Or of Svalöf.

If the Brie oat is the type notable for quality, the white Ligowo oat is the type notable for quantity. The latter shows also :

(1) resistance to lodging ; (2) a tendency to early cropping which ensures success in almost all localities on rich or medium soils, as much in Central France as in the North (if sown in the autumn) ; the suppleness of temperament ensures regular cropping from year to year.

Objections to the Ligowo variety are raised owing to its brittle straw

and thick and hard glumes which completely envelop the caryopses in such a way that the grains pass into the excrements of old horses with defective mastication. The glume percentage under ordinary conditions oscillates round 28% ; and for the Brie oats, round 23%. The food value of the skin being very weak, compared to that of the caryopsis, it can be admitted without much error, that at equal rates, Ligowo should cost 5 to 7 % less than " Brie ". The reduction in cost of Ligowo should lie chiefly with freshly crushed grain, in order to ensure complete caryopsis assimilation.

The preceding remarks show that Brie and Ligowo possess altogether different properties. If their qualities were united, an almost perfect oat would be obtained. It was for the season that the Station undertook work in connection with the crossing of the two varieties. The author hastens to add that no direct result has yet been reached.

The following is the schedule of the faults and qualities of the Ligowo × Brie oat.

Glumes and Awns. — The chief fault with the hybrids lies with the production of grains similar to Ligowo grains with thick skins, and with awns, the awns make them less attractive, as they have only been partly picked off by thrashing ; they decrease the weight of the hectolitre. They can be of inconvenience when oats are sown by the drill machine.

A yearly variable proportion of double grains has been discovered, the first completely sterile at the base enveloping the second.

Table I shows the glume percentage of the hybrids and their descendants and also in the following Tables, the author includes Victoire de Svalöf. The present reputation which this excellent variety has acquired in France, and elsewhere, encouraged comparative tests to be made.

TABLE I. — " *Glumes* ".

A — EXPERIMENTS 1915.

Brie	23,35%	Hybrids Ligowo × Brie			N° 9	26.11%
Ligowo	28,60	»	»	»	N° 27	29.72
Victoire (Seger) . . .	27,85	»	»	»	N° 176	28.45
					N° 186	26.80

B. — EXPERIMENTS 1919 (refined grain).

Brie	21,70%	Hybrids Ligowo × Brie			N° 9	24.10%
Ligowo		»	»	»	N° 27	28.80
Victoire	27,20	»	»	»	N° 176	26.80
					N° 180	23.20

27 and 176 very nearly contain the same proportions as Ligowo ; 9 and 186, slightly weaker proportions. It has already been noted that is advisable to crush Ligowo in order to increase digestibility; the hybrids should be treated in the same way.

Straw. — The very dry summer of 1919 allowed the author to make observations as to the relative turgidity of the chaff of Ligowo, and Victoire and the hybrids. The yield was as yet only limited, and the Ligowo straw and Victoire straw broke like glass when cut in dry weather. In the hybrids, the proportion of straw broken was three or four times less, as shown by the figures in Table II.

TABLE II. — *Relative turgidity of stubble. — Experiments in* 1915. *Percentages of stubble broken in cropping.*

Ligowo parent . . .	40%	Hybrid Ligowo × Brie N° 9	15%
Ligowo di Swalöf. .	43%	» » » N° 27	11
Victoire	47	» » » N° 176	15
		N° 186	—

Maturity. — The hybrids are less forward in thus respect than Ligowo and Victoire.

TABLE III. — *Relative maturity.*

	Date of earing	
	1915	1919
Brie	2 July	29 June
Ligowo	30 June	25 June
Victoire	30 June	24 June
Hybrid Ligowo × Brie N° 9.	29 June	20 June
» » » N° 27	30 June	21 June
» » » N° 176.	2 July	23 June
» » » N° 186.	2 July	23 June

Resistance to lodging. — The most outstanding positive character of the hybrid Ligowo × Brie is without doubt, the solidity and elasticity of the stubble and the resistance to lodging. This is far superior to that of Ligowo and even to Seger.

Yield. — The following Table gives the comparative yields of Victoire and the hybrids, representing the Ligowo yields per 100.

	Noisy (1915)	Grignon (1919)
Ligowo	100	100
Victoire.	114,6	—
Ligowo × Brie N° 9.	110,6	124
» » N° 27	135,20	114
» » N° 176	130	109
» » N° 186.	118	116

The hybrids distinctly showed higher yields than Ligowo in both series of experiments.

Resistance to falling off and shelling of grains. — With the Ligowo and Victoire varieties it is not unusual for a certain number of inflorescences at the base of the panicle to fail to ripen, and to drop :

With the hybrids Ligowo × Brie, this is very unusual and in every case, much less marked than with the others. The 'shelling' is also less feared than with Ligowo and Victoire.

Tillering. — The tillering capacity of hybrids is weak, especially compared with the varieties Brie and Grise de Houdon. It is necessary to sow thickly.

Conclusions. — The hybrids Ligowo × Brie, black like the Brie variety, have not inherited the fineness in grain. They can be defined as Improved Black Ligowos. Before the war, the blackness might have been an attraction, at least in the neighbourhood of Paris, but the more advantageous characteristics recommend themselves to the attention of cultivators.

At the trial experiments carried out at Noisy and Grignon, they all showed up superior to Ligowo and three (Nos. 27, 176 and 86) to Victoire in the following ways :

(1) increase in yield ;

(2) stronger resistance to lodging to falling, off and to shelling ;

(3) more turgidity of straw — during the cropping period, and matured very early, and in very dry weather.

The hybrids possess too, a tendency to early maturity equal to or slighty superior to that of Ligowo and Victoire which suggests the idea that they would accomodate themselves in the same way to quite different conditions of soil and climate.

As they are very productive, it stands to reason, that it is on rich and well cultivated soil that their good qualities show up to the fullest extent ; their feeble tillering capacity demands thick sowing, in order to obtain sufficient stock and to avoid scorching.

These conclusions are drawn from the author's experiments on small areas. How would these hybrids behave cultivated on a large scale ? What is the opinion of farmers who have carried out experiments for the last 4 years ? The author intends to reply to these questions later.

508 – **Heritable Characters of the Maize. "Lineate leaves.** — Collins, G. N. and Kampton, J. H. in *The Journal of Heredity*, Vol. XI, No. 1, pp. 2-6 + 1 pl. Washington, Jan. 1920.

This article is the first of a series in which the authors propose to describe and illustrate the heritable variations of maize as they arise or are discovered.

Abnormalities in maize are of such frequent occurrence that it would be impracticable and probably even undesirable to attempt to describe individual variations. But, as soon as it has been demonstrated that a new character is inherited, and that a stock of seed capable of reproducing the character has been secured, it is desirable to have the variations brought

to the attention of other workers. This will save double work, and variations are less likely to be overlooked.

Our knowledge of the interrelation of Mendelian characters should proceed with increasing rapidity as the number of such characters increases.

If the linear arrangement of characters in inheritance should be found to hold for maize as for *Drosophila*, the proper location of a new character becomes easier as the number of characters whose location is known increases.

Although the majority of the heritable differences in maize are of such a complete nature as to make Mendelian analyses difficult or impossible, alternative characters are coming to light in such numbers as to warrant the belief that maize will rival *Drosophila* as material for the investigation of the linear arrangement of factors and of chromosomes.

From the scientific point of view, a knowledge of the variations latent is of great economic importance, since most of the variant forms are less productive than the normal forms and must be carefully investigated, to be eliminated.

The character here described and designated as "lineate leaves" consists of a number of very fine white stripings on the blades of the upper leaves.

The stripes are usually from $^1/_{10}$ to $^1/_4$ mm., in width and vary from a few millimetres to many centimetres in length, and are very close together. The general effect of the closely spaced stripes gives the blade a grayish appearance that contrasts sharply with the uniform green of normal leaves.

"Lineate leaves" were first observed at Lanham Maryland in 1918, amongst the hybrids between Stowell's Evergreen, and a prolific variety from Brownsville Texas.

The original cross was made in 1912. In 1913, the F_1 population was grown in an isolated block at Victoria, Texas. In 1914, an F_2 population was grown at Lanham, and from the crossing for the two plants, the ear designated Ph 124 was secured.

Plants from Ph 124 were grown in Chula Vista (California) in 1915, and 1916 again in Lanham (Maryland) when one cross pollinated ear Ph. 124 LI was secured. In 1917 seeds of Ph. 124 were again sown, together with seeds of Ph. 124 LI. From these sowings there were secured 16 cross pollinated ears of Ph. 124, 31 cross pollinated ears of Ph 124 LI, and 8 crosses between Ph. 124 and Ph. 124 LI.

In 1918, the 16 cross pollinated ears of the Ph 124 progeny and 3 of the crosses Ph. 124 × Ph 124 LI, were planted. Lineate leaves occurred in 3 of the 16 progenies of Ph. 124, and in one of the crosses between Ph. 124 and Ph. 124 LI.

The adjoining Table shows the ratio of normal green plants to lineate plants.

Number of Lineate and Number of Green Plants in four Progeny grown from hand-pollinated ears.

Progeny destination	No. of green plants	No. of lineate plants	Ratio green : lineate
Ph 124 I, 2	15	7	16.5 : 5.5
Ph 124 I, 3	20	11	23.3 : 7.7
Ph 124 I, 5	18	6	18.0 : 6.0
Ph 124 I, 10.	24	8	24.0 : 8.0
Total	77	32	82 : 27

The ratios are all reasonably close to the monohybrid 3 : 1. The results may be explained by assuming that one parent of Ph. 124 was heterozygous for lineate, a simple Mendelian character recessive to the normal green.

509 – **Pedigree Selection of the Local Variety of Rice "Phung-tien" in Indo-China.** — CARLE, E., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Vol. II, No. 1, pp. 26-32. Saigon, Jan. 1920.

The author gives first the characteristics of the local variety "Phung-tien" with instructive comparisons of the results obtained by tracing selection pedigree. These characteristics are as follows :

Source	Bentré
Date	1911
Colour of bran	yellow
Shape of grain	slightly elongated
Weight of 1000 grains	29.429 gm.
Percentage + red husk	0.46 »
Total percentage of husks	80.04 »
Percentage of bran	19.96 »
Yield per hectare	1500 to 2200 kg.
Period	6 months

SELECTION. — At the Phu-my Experimental Station 1915-1916, the seed and selection origen of 100 plants were marked and numbered when mature (*Elites Vilmorin*). These were cropped separately, then underwent investigation in the Laboratory and were weighed successively with a view to their registration on a special Table.

Numbered according to each individual species or line, the 5 best have been picked out, from the 100 mentioned after examination of the data given as a result of this experiment (1915-1917).

1st *Generation.* — In 1916 and 1917 at Phu-my several hundred plants for each line were grown, and each group derived from one single seed.

2nd *and* 3rd *Generations.* — These experiments were conducted in 1917 and 1918 in the same Station, but on different plots for each new genera-

tion ; in this case also, several hundred individual plants were under investigation.

The statistics registered for these 4 generations are shown in the following Table.

No. of line	No. of ears per 100 plants	Weight of ears in kg.	Average weight of one ear in gm.
	1st. Generation		
365	845	1 551	1.83
348	702	1 441	2.05
329	779	1 432	1.13
359	588	1 322	2.24
379	674	1 281	1.90
	2nd. Generation		
365	560	1 456	2.60
348	586	1 554	2.65
329	582	1 754	3.00
359	625	1 570	2.50
379	621	2 053	3.30
	3rd. Generation		
365	641	1 600	2.45
348	893	1 709	2.00
329	770	2 102	7.73
359	660	1 911	4.00
379	858	2 373	2.70

These figures give an idea of the comparative value of each line and furnish a market criterion of choice.

CULTURAL COMPARATIVE TESTS ON ORIGIN " POPULATIONS ". — Cultures made with ordinary seed, picked out and sorted (MAROT and the CERTANI method) show that from 1916 to 1917 and 1917 to 1918, the yields varied from 1400 to 2400 kg. per hectare Compared with this, from 1918 to 1919, a sufficiently extensive plot was used to sow seeds from a mixture of several selected lines of the 2nd generation ; the yields obtained were good, from 2,300 kg., the yield rose to 3489 kg. per hectare.

The important comparative cultural operations are still in progress not only at Saigon, but also at Tanan.

The pure line cultures have been conducted this year in such a way that the results from February to March 1920 are now on record.

HOMOGENEITY. — One of the most striking and advantageous characteristics of the pure lines relative to the common varieties is the homegeneity and uniformity of the cultures. The differences in the number of heads in each group and between the weights of the spikes on

the same plant are considerably lessened as a result of the selection whilst at the same time the produce increases.

Similar uniformity is encountered with regard to tillering, height, vigour of growth, inflorescence and maturity. The variation in the date of flowering, in the case of one line raised from another is up to 15 days; whilst for individual plants of the same line, there is a perfect correspondance fn date.

General conclusions. — The different observations made from the experiments, and which were taken from a certain number of local varieties are as follows:

(1) Homogeneity and uniformity.

(2) The obtaining of an optimum tilth varying with each variety for the same place: at Phu-my the optimum is from 5 to 9 ears per group; variety Ra-may; for other varieties, this optimum varies, but does not exceed 12.

(3) It is from the 3rd or 4th generations that the lines give the maximum yields.

(4) The average weight of the head improves according to selection pedigree, and this is maintained aften the 2nd generation.

(5) The average weight of the seed increases and remains high compared with the average weight of the seed from the original.

510 – **Improvement of Rice by Selection and Hybridisation in Java.** — Viellard, P., in *Bulletin agricole de l'Institut scientifique de Saïgon*, Year II, No. 1, pp. 11-15. Saigon, Jan. 1920.

The methods of selection employed at Buitenzorg on the same lines as those employed at Svalöf for the cereals in Northern Europe are based on the following facts, in accordance with botanical and genetical theories held by a large number of specialists:

(1) The cultivated varieties of rice (these should not be confused with botanical varieties) include a considerable number of fixed strains, similar to those known in the botanical world under the name of "subspecies" or "Jordan species".

(2) Each of these strains differs from the surrounding types of the same variety in characters of neglible importance morphologically, but which mean a great deal from the cultural standpoint, (*e. g.*: yield, early maturity, resistance to disease, etc.). These distinctive characters are admittedly entirely transmissible to progeny.

(3) Compared with the habit of several other cereals, self-pollination is the usual habit with rice, and cross-pollination is very rare. This certainly facilitates to a large extent the process of selection, as it permits close spacing, and of several pure lines coming from the same or different varieties, without running the risk of undesirable crosses.

It is easy to see, therefore, that if a cultural variety is selected which shows a combination of good characters (weight of yield, quality of grain, resistance to disease), or which possesses one of these points to a marked extent, it will be sufficient to multiply a pure line to obtain several gene-

rations later, a new cultural variety following the natural course, but with the advantage of each individual possessing qualities of a select strain superior in one form or another to the original variety («population »).

The following is a brief survey of the method employed in Java at Tjikenmeuh.

The " population " rice is sown in the nursery according to the usual custom, and then pricked out on to an area of about 20 acres, with much care taken to avoid putting more than one plant into each hole. Throughout the growing period, the rice field is watched, and out of the 100,000 to 200,000 plants thus pricked out, about 300 select types are chosen.

The record of the yield of each plant is made separately. In the laboratory, the less interesting ones are eliminated, and about 75 to 80 in all, are conserved. These will form the origin of the pure line selection.

The following year, each of the 75 to 80 lines thus obtained is sown and repricked out, always at equal distances apart, on small plots (4.7 to 7 sq. yds.). Three plots at least, are reserved for each line and these are distributed in various quarters of the field, so as to avoid variations due to dissimilarity of soil. In the harvest season, the produce from all the plots is collected at the same time. In this way 75 to 80 crops are obtained, and these are investigated in the laboratory according to the characters it is desirable to retain.

The third year, work is not continued with the 10 to 15 best lines in the second selection, but this time the plots reserved for each line are multiplied as far as possible. The crops thereby obtained serve as a base for the definite choice of the type, or types, which will advantageously take the place of the original " population ".

At Java, up to the present time, a dozen varieties have undergone this method of selection and have furnished twenty pure lines. These lines multiplied over large areas, for the last 2 or 3 years in control plots have shown homogeneity and fixed characters as expected. With regard to the yield, there was an average increase of 20 %.

It is noticeable, as predicted, that the results obtained showed a distinct improvement to the original and less homogenous population.

The Tjikenmeuh Station is assisted in plant breeding work by the co-operation of the " Jardins de semences " directed by M. VAN DER STOK, and the work extends over the centre and east of Java and to demonstration fields at the local agricultural schools. It is reasonable, therefore to hope that the results, already distinctly advantageous, will be accentuated and confirmed in the near future.

The author gives a brief survey of the hybridisation experiments made at Tjikenmeuh.

Artificial pollination of rice is a somewhat difficult operation which was for a long time considered impossible.

M. VAN DER STOCK, who was the first to succeed, has, however, never obtained more than a very minor degree of success. The local varieties,

crossed 7 years before and with progeny followed with great care up to the present time are "Skriviman Koti" and "Carolina". The first is a plant of very considerable vigour, leaves dark green, form erect. The yield is high but unfortunately the grain is of an inferior quality. The second variety, on the contrary, shows lack of vigour, the leaves are large, light green and drooping, but it makes up for this by producing grain, although in poor quantities, of the biggest and best quality obtainable in Java and perhaps even in the whole world. The flowering period is 3 weeks earlier than that of Skriviman Koti.

Hybrids are selected in each generation. F_7 under the authors' observation, gave more than 200 hybrids cultivated on plots of an average area of 7 sq. yd., and which showed a combination of characters of the 2 parents. In several cases "transgression" was noted.

Certain hybrids flowered 8 days earlier than Carolina (the variety which matures the quicker of the 2 parents). Others gave larger grain than Carolina. These facts are sufficiently encouraging to raise hopes, and the confirmation of the results obtained at Tjikeumeh will open up an efficient means of action to rice breeders for the improvement of local varieties, by crossing with superior imported varieties.

511 – **On Variation in Tartary Buckwheat, *Fagopyrum tataricum* (L.) Gaertn. in the United States.** — ZINN, JACOB, in the *Proceedings of the National Academy of Sciences*, Vol. 5, No. 11, pp. 506-514. Washington, Nov. 1919.

Results are shown of a series of experiments carried out by the author on *Fagopyrum tartaricum* Gaertn (*Polygonum tartaricum* Linn.). The high variation and transmission of the external characters made it first necessary to investigate the behaviour of this race under different conditions before attempting an analysis of the underlying genetic causes.

In a population of several hundreds of plants, one plant was found to be distinguished by a particularly high degree of variability in the structure of its flowers. This plant was selected as a starting point of a strict pedigree culture, and since its isolation, five generations have been grown, and involved an examination of more than 57,000 flowers and fruits.

The variations here considered, occur in the gynœceum, the perigone, and the vegetative organs.

The variations in the gynœceum are characterised by the production of supernumerary carpels, varying from 3 to 25 per pistil (instead of the usual 5). Under ordinary conditions of growth, the number of flowers with normal gynœcium predominates over or equals the number of flowers with abnormal gynœcium; the variation curve is consequently unilateral.

Under conditions favouring the development of abnormal flowers, the variation is bilateral, and is represented by a curve, the apex of which is formed by the abnormal 4-carpelled flowers. The percentage frequencies of a number of flowers with 3-4-5-6-7-8-9-10-11-12-13-14-16-18-19 carpels is — 17.98 — **67.73** — 7.79 — 1.71 — 0.64 — 0.86 — 0.49 — 0.75 — — 0.07 — 0.29 — 0.06 — 0.06 — 0.02 — 0.02 — 0.02 % respectively.

Associated with the abnormal gynœcium are abnormal perigones with

a number of segments ranging as high as 18. The variation always remains unilateral in the number of perigone leaves. The frequency of the normal, five parted perigones decreases as the number of carpels per pistil increases. The percentage frequencies of the number of flowers with respect to the number of perigone leaves, namely 5-6-7-8-9-10-11-12 is as follows **71.72** — 21.62 — 4.31 — 1.29 — 0.37 — 0.59 — 0.02 — 0.08 % respectively.

Between the number of carpels and the number of perigones leaves, there exists a distinct positive correlation.

All descendants of this race were found to reproduce the type of the mother plant regardless of whether they originated from normal or abnormal fruits of the parent. Conditions of temperature, moisture, and nutrition, considerably controlled the intensity of abnormal development.

Dimorphism manifests itself in two externally different forms ; similar to that found in the case of *Trifolium pratense quinquefolium* De Vries and *Veronica agrestis*.

512 – **Selection in Soy Beans in the Philippines.** — Noroña Maceda, Felix, in *The Philippine Agriculturist*, Vol. VIII, No. 3, pp. 92-98. Los Baños, Oct. 1919.

Layosa had already been engaged in work in connection with selection in soy beans, and the author in continuation of Layosa's theses has undertaken a series of experiments for the following purposes :

(1) The multiplication of strains selected by Layosa and the running of " plant-to-row " tests of the most productive individuals or elites of each strain ;

(2) The isolation of strains that can be recommended for the rainy season or for the dry season under local conditions ;

(3) The comparison of the yield of selected strains with that of unselected plants.

Elite cultures of Amis Beans (217 F_5) during the rainy season.

Pedigree number	Parents	Descendants		
	Computed yield per hectare	Computed yield per hectare	Computed gain or loss over parent	Computed gain over common stock
2 (N_7)	471.73	1192.8	721.1	880.4
3 (N_8)	426.27	1278.0	851 7	965.6
4 (N_9)	563.47	1107.6	544.1	795.2
5 (N_{10})	455.40	606.4	150.9	294.0
Common stock	239 99	312.4	—	—

As a result of favourable environmental and climatic conditions during 1918, the increase in yield from selected strains was obvious.

Similar results were obtained from the " plant-to-row " cultures, providing materials for subsequent multiplication. Each of the four

strains selected by LAYOSA gave in every case a higher yield in beans than their respective parents, at the rate of 55-79 % and more.

Multiplication cultures of Amis Bean (217 F_6 and F_7) during dry season.

Pedigree number	Parents	Progeny		
	Computed yield per ha.	Computed yield per ha.	Computed gain or loss over common stock	Percentage inc. of offspring over common stock
2 (P_7 – N_1)	202.66	511.2	277.8	54 %
2 (P_7 – N_2)	247.99	369.2	135.8	37
0 (P_{80} – N_{17})	243.35	284.0	50.6	18
2 (P_{80} – N_{12})	407.95	397.6	164.2	41
4 (P_{80} – N_{21})	291.72	69.2	164.2	−237
0 (P_{80} – N_5)	557.07	340.0	106.6	– 31
6 (P_{108} – N_{17})	730.67	284.0	50.6	18
9 (P_{107} – N_7)	766.93	340.8	107.4	31
6 (P_{138} – N_{33})	191.19	142.0	– 91.4	– 64
7 (P_{138} – N_{13})	535.55	369.2	135.8	36
8 (P_{138} – N_{14})	751.46	482.4	149.0	31
Common stock	—	233.4	—	—

With two exceptions, all selected strains grown in this work, gave higher yields than the common stock, thus showing the advantage to be derived from selection. The gain in percentages of yield of the selected strains over the common sort ranges, in multiplication plantings from 18 % to 79 %.

513 – **Improvement of Sugar Beet by Selection, in France.** — GAILLOT, M., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 39, pp. 986-995. Paris, Dec. 1919.

The cultivation of sugar beet in the north of France is a subject of real interest : the rotation system is employed in conjunction with wheat production, and results in an entirely advantageous effect on meat value, as the stubble can be readily used for feeding purposes and for fattening livestock.

In addition to this, the sugar industry opens up in the same district commercial undertakings in all branches of national welfare, as, for example, agricultural machinery, industrial institutions, chemical fertilisers for which sugar beet is essential, chemical products, textures and all materials necessary for the equipment of sugar factories.

In spite of all this, the production of sugar beet in the north of France has a tendency to decrease and take a second place in relation to foreign competition.

Although to the outsider the richness of the sugar content in the roots,

and the yield per hectare has always been on the increase, with the result in the natural course of events that the cultivation is increasingly profitable to the agriculturist, this is not the case in France. Quite apart from the questions of climate, soil, manual labour, etc., so often raised, the fundamental cause of this inferiority may be attributed to the fact that, with regard to the production of seed, the French market is entirely dependant on the foreign market. Consequently two serious difficulties are involved :

(1) the agriculturists cannot depend on any profit which is undoubtedly connected with the production and sale of beet-seed ;

(2) the seed employed, even if guaranteed pure, comes inevitably from regions with a different climate and soil, and which, when taken to a new destination, may show some discrepancy, and this is often the case.

The author having insisted on the need of producing the necessary seed on native territory, following the German method, gives an account of the results of his own work of selection started in 1909.

For some years comparison cultivation trials were conducted with the French and foreign varieties considered to be the most adaptable to the various soils in the Soissonnais district. A comparison between the quality of the sugar and the weight of sugar produced per hectare on each type of soil, made it possible to discover the most suitable varieties. Amongst these, certain individual types were selected, distinguished by the development of characteristics which it was desired to stabilise, and these were reserved as parents for future generations and pure line selection.

To speak candidly, it is not a case of pure line selection in the true sense of the phrase. Apart from the ordinary course ; — when the parents are isolated, and self-pollination is necessitated, a mixed progeny is the result with the following predominating features : red beets with white skin and leaves green and red, fodder beets, green and white beets, beets with lanceolate leaves and forked roots, similar to the wild beet, and a small number of individuals comparable with the parent. Also, as is well known the sugar is obtained in successive stages from the fodder beet, and this in its turn is derived in a similar fashion from the wild beet. The isolation in this particular case, has the habit of encouraging atavism by the dissociation of the characters in the beet.

By enclosing two instead of one specimen under the same cover, or even in the open air, the number of good roots attached to the progeny increases, even if there is always a higher percentage of natural material due to self-pollination. It is sufficient if the two types do not flower simultaneously, to ensure self-pollination.

To avoid mishap, the author believes it necessary to have recourse to crossing parent stock, by collecting them is small groups of 4 to 7 and engendering a simultaneous flowering period by constant pinching of of buds. In order to obtain good results, it is important that the individuals as far as possible, possess the same characteristics. Their choice, however, will depend largely on a thorough investigation of the characters dur-

the various phases in growth development up till the moment when the productive organs are developed.

The seeds thus obtained are taken from each plant and sown separately plots, and the plants submitted to careful examination with respect to ir botanic and physiological characters, such as :— late or early matu-y, number of leaves, weight of root, sugar content and its quality, etc. e final choice is limited to types which transmit exactly similar charac-istics to their progeny. These are reserved definitely as parent stock, d the seed sown the following year on plots devoted entirely to parent ck.

The beets collected from each plot undergo thorough examination the field and in the laboratory. The chemical analysis is made both in d and warm aqueous solutions, and the beets have been subdivided follows : 1) " super-élites " — to serve as new parent stock ; 2) " élites " grand-parents, to serve as the source of seed for commercial purposes.

The super-élites have naturally been studied with the minutest at-tion and a special record kept, following the GALTON curves method which the percentage of beets showing equal proportion and equal ality in each family is signified. The plans, diagrams and illustrations, c. make the comparison between the various progeny easy and effectual. the beet is a perennial, it is hoped to maintain the production over per-élites as long as possible. It is certain that, in any case, the yield seed decreases year by year, and it is the same with regard to the sugar ntent, which is 20-22 % before transplanting and then falls to 4-6 %. e author intends to keep a record of the value of the seeds thus collected several years in succession, and compare these with the first year ults.

The élites are also a subject of observation and of rigorous selection ring the growing period. All the élites proceding from different families t belonging to the same order, are planted out close to each other, to able ready crossing. The seed thus obtained is reserved for use to grow nts intended later to furnish seed for commercial purposes.

4 – **Variation of the Coconut tree observed in Ceylon.** — *The Tropical Agriculturist*, v. LIV, No. 1, p. 1. Peradeniya (Ceylon), January, 1920.

Some years ago, in the North Western Province, a coconut tree was ticed which bore yellow and green fruit at the same time. The main nk showed longitudinal green and yellow stripes ; and the branches which rang from the green stripes produced green fruits and those from the yel-w stripes produced yellow fruit.

By sowing two nuts from the two different types, two young plants were tained, one normal and green, the other of a yellow shade with the midrib its leaves, yellow or bronze.

This case is interesting in that it indicates that yellow varieties of co-nut could reasonably be obtained from the normal green type by fol-wing the variations of the shoots.

5 – **Probable Origin of the Dwarf Cocoanut Tree.** — See No. 524 in this *Bulletin*.

516 – **Fasciation and Dichotomy following the Grafting of two Portuguese Vines.** — José Duarte d'Oliveira, in *Comptes rendus de l'Académie des Sciences*, vol. CLXX, No. 10, p. 615-616. Paris, March, 8, 1920.

The variety Gonçalo Pires of Portuguese Vine grafted on *Riparia* × *Rupestris* 3309, and characterised by the development of fasciated branches, nearly always dichotomous, produced much fruit, but wine of only medium quality.

On this vine the author regrafted the variety "Albinio de Souza" (red) which produces a small crop but excellent wine and shows no signs of fasciation or dichotomy.

Grafting was done in March 1919. In June it was noticed that the shoots of the scion Albinio de Souza were fasciated and dichotomous just like the stock Gonçalo Pires; the scion continued to grow in exactly the same way as this stock.

This then is a case of transmission of two specific characters from stock to scion.

517 – **Illustration of the Definite Principles of Heredity Hybrid *Catalpa : Catalpa bignonoides* × *C. Kaempferi*.** — Jones D. F. and Filley W. O. in *The Journal of Heredity*, v. XI, No 1, pp. 16-24 + 9 figs. Washington, Jan. 1920.

The result of a series of experiments with the hybrids *Catalpa bignonoides* × *C. Kaempferi*. The cross was made by emasculating the flowers of *C. bignonoides*, enclosing them in bags, and later applying pollen of *C. Kaempferi* by hand.

Comparison of the First Genetation Hybrid of *C. bignonoides* by *C. Kaempferi* with its Two Parents Species

		C. bignonoides	*C. bignonoides* ♀ + *C. Kaempferi* ♂	*C. Kaempferi*
Bark		Rough	Smooth	Smooth
Leaf-upper surface		Glabrous	Pubescent	Pubescent
» lower surface		Hirsute	Sparingly hirsute on young leaves	Glabrous
» shape		Generally ovate	Generally cordate	Generally cordate
» margin		Entire	Three lobed rarely entire	Three lobed rarely entire
Petiole		Slightly coloured on young leaves	Coloured	Deeply coloured
Insertion of petiole		Not coloured	Not coloured	Coloured
Flower - colour		White with brownish purplish spots and orange stripes.	White with brownish purplish spots and orange stripes	Pale yellow with brownish purplish spots and dark yellow stripes
Pods	length	3 to 3.5 cm	3 to 3.5 cm	2 cm
	breadth	3 to 3.5 cm	2 to 2.5 3 cm	2 cm
	length	30 to 35 cm	20 to 40 cm	20-30 cm
	breadth	1 to 1.5 cm	.5 to 1 cm	.3 to .5 cm
Seeds	length	2 to 2.5 cm	2 cm	1 cm
	breadth	.7 to .8 cm	.3 to .4 cm	.2 to .3 cm
	hair length	2 cm	1.5 to 2 cm	.7 to .8 cm

There is then an intimate fusion between the two parent species. This is a good example of a species cross of the type already studied with so much interest by KÖLREUTER, GARTNER, FOCKE, etc.

The largest proportion of hybrid characters are intermediary; the leaves of the Japanese Catalpa are pubescent on the upper surface, and glabrous on the lower surface; with the American Catalpa, the upper surface is glabrous and the lower surface hirsute. The hybrid resembles both parent species, and is velvety on the upper surface, and sparingly hirsute on the lower surface of the young leaves.

There are certain points which show a predominant resemblance to one special parent; for example, the bark is smooth and the margin of the leaf three lobed like *C. Kaempferi.*

The dimensional characters of the hybrid are intermediate except in the diamater of the trunk, size of leaves, and inflorescences. In these the hybrid clearly excels its parents, thanks to to its stronger development generally. *Catalpa bignonoides* × *C. Kaempferi* also distinguished by its resistance, at low temperatures to leaf spot, *Macrosporium catalpae* E. and M.

Experiments have not yet been made with F_2 when the characters are distributed, with the result that numerous forms appear, some of which could doubtlesss be picked out and propagated.

The hybrid is identical to the "Teas' Hybrid Catalpa" which very likely was produced by the cross *Catalpa bignonoides* × *C. Kaempferi.*

18 – **Seed Survey Report 1919 in Canada.** — EDDY, F. D. (Chief Seed inspector Dominion Department of Agriculture, Canada), in *The Agricultural Gazette of Canada*, Vol. VI, No 12, pp. 1033-1035. Ottawa, Dec. 1919. SEEDS

The war greatly interfered with the regular channels of seed trade in Canada and the United States. For many kinds of seeds, particularly root and vegetable, the American continent had been depending largely on European supplies. But the war having interrupted seed production in Europe, and owing to the difficulties of transport, it was impossible for Canadian and United States seedsman to secure delivery from overseas of many kinds of seeds and the production of seed on the American continent was undertaken on a larger scale than ever before. The situation was further complicated by poor crops of some kinds of seed in America; and it was considered advisable to institute more strict government supervision of seed distribution.

A special Seed Reporting Service was established under the Bureau of Markets by the United States Government to procure and distribute information respecting seed supplies, and the Seed stocks Committee was formed to advise the War Trade Board respecting the issuing of export and import licenses for seed shipment. In Canada, the seed Branch acted much in the same capacity as the Seed Reporting Service and the Seed Stocks Committee did in the United States Department of Agriculture. One of the most important features in connection with securing information regarding the available seed supplies, has been the semi-annual seed survey

Seed survey. June 30, 1919.

Item	Stocks on Hand June 30		Total Receipts Year Ending June 30	
	1919	1918	1919	1918
	Pounds	Pounds	Pounds	Pounds
Red Clover	34 580	560 628	3 870 360	5 487 417
Alsike	39 655	1 034 456	15 619 396	10 226 737
White Clover	12 518	32 165	65 120	60 750
Crimson Clover	3 967	7 586	1 545	5 538
Sweet Clover	10 784	261 668	1 744 327	802 169
Alfalfa	64 883	167 868	607 430	676 732
Timothy	842 965	3 465 285	9 746 064	12 867 809
Red Top	104 415	88 320	138 726	136 777
Orchard Grass	4 758	27 521	18 565	15 328
Kentucky Blue Grass	33 198	66 648	60 391	58 292
Canada Blue Grass	247 262	349 438	1 427 528	1 805 659
Bromus Inermis	7 441	4 625	566 435	156 533
Western Rye Grass	45 907	56 088	369 609	263 390
Meadow Fescue	3 018	6 549	14 031	15 071
Common Vetch	39 923	333 793	958 705	701 333
Hairy Vetch	5 029	39 609	62 924	63 669
Common Millet	202 707	172 372	464 184	276 059
Foxtail Millet	301 684	200 332	670 560	255 889
Barnyard Millet	9 047	34 341	17 818	40 611
Rape	120 443	147 532	245 442	229 140
Seed corn	1 045 322	1 356 537	10 564 268	15 196 109
Beans, D. Snap	366 464	233 421	655 411	471 053
» Garden Pole	36 003	16 033	139 857	98 358
Beet Garden OS	20 429	36 103	19 607	38 434
» » AM	42 786	20 632	60 270	24 544
» Mangel OS	256 612	260 934	151 933	177 775
» » AM	13 676	2 863	28 599	9 123
» Sugar OS	265 596	506 186	307 600	234 72
» » AM	90 346	44 187	71 089	49 971
Cabbage OS	9 493	9 404	6 600	3 926
» AM	10 383	5 093	8 706	8 306
Carrot	55 292	38 533	60 477	51 150
Cauliflower	1 439	665	1 873	790
Celery OS	1 418	1 646	536	461
» AM	2 065	1 318	1 367	1 319
Cucumber	37 531	31 003	32 599	30 082
Kale	1 164	1 262	488	973
Lettuce	24 121	18 875	20 064	20 017
Muskmelon	3 809	3 853	2 308	2 467
Watermelon	6 253	6 253	4 331	4 584
Onion Seed OS	11 201	1 206	14 381	4 884
» » AM	54 906	26 810	81 219	48 741
» Sets	—	—	1 808 148	2 073 903
Parsley	30.8	3 242	3 642	2 982
Parsnip	7 220	1 936	13 367	9 556
Peas, Garden	3 520 758	892 747	18 939 148	13 548 263
Pepper	728	545	552	503
Pumpkin	7 446	9 132	7 578	9 590
Radish OS	20 960	15 501	14 324	7 770
» AM	37 413	22 489	49 194	29 531
Salsify	819	747	777	1 086
Spinach OS	14 814	14 621	13 697	11 359
» AM	12 929	992	15 587	2 185
Squash Summer	3 753	4 318	4 481	3 016
» Winter	3 294	2 464	2 932	3 484
Sweet Corn	212 669	55 339	486 011	210 473
Tomato	6 924	4 659	5 495	4 452
Turnip, English	127 07 7	95 929	64 432	67 723
» Swede OS	335 522	197 730	278 988	244 446
» » AM	6 822	1 339	21 799	9 412

N. B. — OS produced over seas — AM — produced in American continent.

conducted concurrently in Canada and the United States. Seedsman and seed growers were required to make returns showing stock on hand, total receipts and exports at or during stated periods. With this information it was possible to know whether seed requirements for the season were in sight, and to give reliable advice respecting applications for trade permits.

The first survey was conducted in the United States on February 1st, 1918. This was followed by three others on July 1st, 1918, January 1st, 1919 and June 30th, 1919. The complete figures of the surveys made in Canada on June 30th (1) are presented in the adjoining Table.

The principal items reported as exported during the year ending June 30th, 1919 are as follows (pounds in all cases) : Red Clover, 850 165 ; Alsike 10 019 462 ; white clover 8 000 ; Sweet clover ; 1 016 126 ; Timothy 404 266 ; Canada Blue Grass 615 994 ; Common Spring Vetch 492 000 ; Hairy Vetch 22 544 ; Dwarf Snap Beans 61 641 ; Garden Pole Beans 96 000 ; Garden or Canning Peas 8 640 594.

519 - **The Drying of Beet Seed.** — See No. 529 of this *Review*.

520 - **On the Origin of Forests.** — See No. 536 of this *Review*.

CEREAL AND PULSE CROPS

521 - **Experiments in Sowing Barley, made from 1909 to 1915 in Denmark.** — IVERSEN R. (136 Beretning fra Statens Forsogs wirksomhed i Plantekultur) in *Tidskrift for Planteaol*, Vol. XXVI, Pt. 3, pp. 377-417. Copenhagen, 1919.

Experiments were carried out to determine the influence exercised by the quantity of seed and the method of sowing on the yield of barley and on lodging. The idea was to compare broadcast sowing with sowing 10 to 20 cm. between the lines, with different quantities of seed, limited to from 76 to 180 kg. per hectare. These experiments lasted 7 years, 1909 to 1915, at 4 Danish Agricultural Stations (Lingby, Tystofte, and Askov Lemmerk). The barley employed was a local variety (Tystofte Prentice), Archer type. Cultures were made in sixfold and tenfold plots, as a rotation crop following forage crops or legumes, and well manured. The yield in grain and straw was determined in hectolitres and also the size of the grain ; a valuation scale was used for the amount liable to lodging (1 to 10).

From the results, it can be concluded that the seed sown broadcast gives nearly the same amount, quantity and quality as that sown on the 10 cm. between the lines system.

The more important factor would be not so much the manner of sowing as the quantity of seed employed : it is this factor which determines the different possibilities of development in cultivation and perspective yield. It should also be noted that seed sown on the 20 cm. between the line system produces, on an average, 1 quintal of grain less per hectare than in the lines 10 cm. apart.

(1) This service has been suspended ; a résumé of the results obtained will be given shortly in a *Review*.

These results confirm the observations made by CAR. SONNE on the relation between seed employed and conditions of development. It can generally be assumed that the more the conditions of development are satisfactory the less seed is necessary to obtain the maximum yield. The barley seed sown in lines 10 cm. apart gave the following results :

Total harvest per ha. (grain and straw)	Quintals of grain from obtained per hectare		
	109 Kg.	133 Kg.	160 Kg.
90 quintals	41,0	40,3	40,2
75	33,3	34,3	33,3
60	29,9	30,5	31,3

As to the weight and the size of the grains, they increase when the quantity of seed employed decreases. Experiments appear to indicate that in employing relatively small quantities of seed, lodging can in limited areas be obviated. However, that has no value in practical farm work, seeing the quantity of seed which it is necessary to use in agricultural practice.

FIBRE CROPS

522 – **The Cultivation of Cotton in the French Colonies.** — I. La culture du cotonnier dans les colonies françaises, in *Le Bulletin des Halles, Bourses et Marchés*, Year I, XXIV, No. 263, p. 1. Paris Dec. 7 and 8 1919 (article reproduced in the *Bulletin de l'Union des Agriculteurs d'Egypte*, Year XVIII, No. 131, pp. 9-14. Cairo, Jan.-Feb. 1920). — II. Rapport du President de l'Association cotonnière coloniale, in the *Association cotonnière coloniale, Bulletin* Year XVII, No. 61, pp. 631-645 + 1 pl. Paris 1919. — III. Le coton dans l'Afrique du Nord (1). — IV. Au Maroc Occidental. *Ibidem*, pp. 654-663. — V. RODIER, A la côte d'Ivoire. *Ibidem*, pp. 645-652. — VI, RODIER. Au Soudan, *Ibidem* pp. 652-654. — VII. En Guinee Française, *Ibidem*, pp. 680-692. — VIII. En Nouvelle-Calédonie, *Ibidem*, pp. 663-665. — IX. Aux Nouvelles-Hébrides, *Ibidem*, pp. 665-667. — X. AHUNE, A Tahiti, *Ibidem*, pp. 692-695. — XI. A la Guadeloupe, *Ibidem*, pp. 696-698. — XII. Au Cambodge (2).

I. The cotton question is more than ever the order of the day. — There are at present 3 principal sources from which cotton is obtained ; the United States, Egypt, and India. The first of these three shows a production of $^2/_3$ the total product of cotton manufactured throughout the world. ; the third shows about $^1/_4$ the American product, and double that of Egypt. The yield in India is chiefly utilised in India and in Japan. In Egypt special superior quality fibre is found, and utilised in the fabrication of extremely fine thread. It really amounts to the fact that, for European manufacture, the only provision markets for first class matter are American, and this is absolutely dependant on the fluctuations and flexibility of production. Since the beginning of the war, considerable variations in yield were reported in the United States ; on the other hand, whilst formerly this country used up only a small part of her national cotton, to-day, these manufactures have almost doubled their production (in 1910, they used 35 % of the American yield ; in 1915, 60 %) ; therefore col-

(1) See *R.* Oct-Dec. 1919, No. 1138.
(2) See *R.* Dec. 1908. No 1355. (*Ed.*).

sidering only the upkeep of prices and the world revenue which ought to come in from their crops, the growers do not hesitate in case of need to limit the sale or to reduce the outlay in order to gain their ends.

There is then a considerable danger facing the European cotton industry, especially in France, where this industry is very important. There are 100 000 spinners and weavers occupied in this trade, representing a population of 1 200 000 people.

There is therefore opportunity to develop the production of cotton in the French colonies, and the author gives a rapid survey of the production and cotton trade possibilities in the various French colonies and the work of the Colonial Cotton Association. It is for this reason that the cultivation of cotton has taken a hold in these colonies. The experiments carried out have proved the best species of cotton fibre obtainable in each region and giving the highest yields. It is the idea to increase cultivation in such a way as to dispose of uniform abandoned sorts, with due order, to produce thread of identical quality from one end of the year to the other ; production should be intensified in these colonies and this is the aim of the Colonial Cotton Association.

II. The President of the Colonial Cotton Association reports the work of this Association during recent years in the French colonies, and lays stress on the duties that fall to its lot, and on the programme of action on which the Association should rely in order to carry out this lengthy enterprise which it has undertaken.

III and IV. Northern Africa ; especially Morocco. — The question has been largely discussed in the « *Annales de la Science agronomique* » by M. V. Cayla for Egypt, Algeria, Tunis and Morocco, and by the same author in *L'Agronomie coloniale* for French Northern Africa in particular. A résumé of this work as a whole was given in 1919. (See Note).

In the present investigation, special attention is paid to the question of cotton in Morocco. It is a recognised fact that cotton was previously cultivated in this region and was carried on to a fairly large extent fifty years ago. There are still traces of this to day. The cotton found is a hybrid producing a very fine quality fibre, about 30 mm. in length.

Owing to the climatic requirements of cotton, the chief growers limit as far as possible their plantations to the plains with a maritime climate. This necessity which appears to have been confirmed in the case of Morocco, as the result of test experiments since 1913, considerably limits the extent of territory possible for the cultivation of cotton. Economically, especially as the spring frosts are felt even on the coast, this necessitates the seed-sowing during april. Then cotton, also demands, for normal evolution, a sufficiently long period of vegetation, which means in Morocco, particularly outside the coastline area, a period between the spring and autumn frosts. What is more, the rainfall is very badly distributed in Morocco with regard to cotton cultivation. Cotton cultivation on dry soil therefore seems hardly possible *a priori* in the Cherifien Empire, and in fact, the trials carried out up to the present time, obviously confirm this opinion, anyhow for the long cotton silk varieties, the only varieties with which cultivation was attempted.

Amongst the Egyptian varieties, the " Nubari " has given the best results; 4 quintals of cotton fibre with irrigation and barely 1 quintal on dry land

It seems obvious that irrigation is necessary for cotton cultivation in Morocco, and that it could only be developed as far as water works would allow planters to have use of the water indispensable for plant development.

Although the cotton may be not be very particular from the point of view of the type of soil on which it is grown, it has nevertheless a preference for clay loam or deep sandy argillaceous soils, and there again, the possibilities in Morocco are limited.

After consideration of these conditions, it can be estimated that an area of about 20,000 hectares (situated chiefly in the Sebon valley and its tributaries) can be sown with cotton. It seems wise to adopt the triennial rotation crop system followed in Egypt, and this will necessitate the fitting up of an irrigation system to cover 6,000 hectare.

A survey of these facts indicates that the production in appreciable quantities cannot be realised immediately and will never be considerable. Allowing for a yield of 6 quintals of cotton fibre per hectare an annual production of 120,000 quintals per 20,000 hectare should be expected.

In addition to this, it should be noted that all the cottons which have been produced in Morocco have been declared of excellent quality by expert authorities on the Colonial Cotton Association.

There now remains the question of short staple cotton; the production of this is more immediately possible as it would only mean a reasonable treatment of the land, and this could be carried out at the earliest opportunity. However, it should not be forgotten that cotton needs in order to ensure success, suitable soil, well worked and manured.

The reasons for limiting the cultivation shown for the "long staple" are the same for short staple except as regards irrigation, and the possibilities of sowing are therefore greater. On the other hand, the short silk is less delicate and earlier than long silk. It is to be feared, however that owing to the small rainfall in Morocco, the production may not be sufficiently remunerative. It is wise in every case to count only on the low yield, not exceeding 2.5 quintals per ha. obtained in America under much more favourable conditions. It must also be remembered that in Morocco, manual labour is rare and dear, and it should not be forgotten that, except at abnormal periods, as at the present time, cotton cultivation, even in Egypt entails somewhat high expenses.

V. Ivory Coast. — From 1914 to 1918, the production of raw cotton in this colony rose from 0 to 2000 tons; 3 principal factories and 6 secondary, have been set up in spite of the war which considerably reduced the number of administrative staff and necessitate the use spinners and native employees. The result seems to promise well for the future and it is hoped that the Ivory Coast will be some years hence an important cotton centre.

The North Coast of Ivory shows the most promise, and especially at Booulé.

Cotton from the Ivory Coast is now known and appreciated. The question is well under consideration, and before another ten years, the problem will be completely solved and the cultivation of cotton definitely established in the colony.

VI. Soudan. — Cultivation of cotton could be extended to north of the Ivory Coast, and the author thinks that quite a large part of Soudan is capable of production. The Colonial Cotton Association already possesses 3 factories at Segou, San, and M'psoba. The scheme would engender the development of cotton cultivation in the neighbourhood of these 3 factories, in various directions, to support the Government of the Ivory Coast in the region of Khorogo, connected with Bougouni, Sikasso, Bobo-Dioulasso. Work in the country will be easy as far as Timbuktu by road and car to Mossi, (population 3 millions.) The only difficulty will be to find the necessary personnel.

VII. French Guinea. — The tropical climate in this colony has two seasons, one dry, the other rainy, and relative to this, it is suited to cotton cultivation.

However, near the coast, the amount of rainfall during the 6 months winter, which exceeds 3 m. and the persistance of damp winds, are both unfavourable factors. In Kissidugu Guinea and Liberia the showers which continue to fall during the dry season, mean a large quantity of atmospheric humidity, and are also contrary to production, and hinder the ripening of the capsules.

In every part of the colony, land suitable for cotton is found. But the sandstone which forms a broken belt round the mountainous region of Futa hinders the normal development of the crop unless the land is well manured.

From the economic point of view the question may be considered as follows: — In Southern Guinea, the farm population can devote their time successfully to the cultivation of rice, palm, and the fabrication of palm oil. Cotton cultivation does not present much opportunity, especially as cattle are scarce.

In other parts of the Colony, cotton production is bound up with several factors.

In the first place the existance of lines of communication. The existing lines of communication, are the railway from Conakry to Kankan, the rivers Niger, Niandan, and Mile, the new carriage routes from Mamon to Labé from Bissikrima to Dinguiray, from Dabola to Farhna, land also a large number of roads, several of which have been fitted up for the passage of oaded donkies. But the beasts of burden belong to Dioulas in connection with the traffic between Sierra Leone and Soudan, and are scarce.

The cultivators in Guinea, who do not possess animals ought to have their produce carried on the head from the cotton fields to the railway station or to the relays on the carriage routes.

This does not include the number of districts where cotton production can henceforth be organised north and south of the Colony, bordering on Portuguese Guinea, Senegal, North Senegal, Niger, Liberia and part of Sierra Leone *a fortiori*, the part in the neighbourhood of the Ivory Coast. Efforts should be made in districts which not do mean more than 50 km. lines of communication, railways carriage routes, navigable rivers, as enumerated above.

In these countries, the extension in cultivation will be dependant on two factors, density of population and cattle.

Following these lines, central Fouta is the most adaptable. But, as it is very hilly and the land of suitable and sound texture for cultivation is already covered to a large extent, cotton production will never be undertaken to anv large exten.

The plains surrounding Fouta, offer on the other hand, immense opportunities for cotton growing. The population is in general, it is true, very scattered. However, next to the almost deserted districts, there are others sufficiently well populated and the inhabitants can direct their attention to cotton cultivation, to a large extent, thanks to the use of the plough.

Nigeria — vallies of the Mile, Niger, Nianda — are populous. The cattle rate has been largely decreased as the result of recent epidemics, but the herds are regaining their former size. The cotton crops are graded in groups along the river banks. Canoes can be used as an economical means of transport of the rough cotton as far as the sorting centres.

This region seemed the best adapted to a combined action of the Cotton Association and the Administration, with a view to establishing cotton cultivation in Guinea.

VIII. New Caledonia. — The recent introduction of cotton cultivation into New Caledonia, and trial experiments for ten years, showed a tendency to rapid development up to 1916 suggesting that this product may become a very important factor in the agricultural production of this colony.

The adjoining table gives the quantities and values of the cotton exports since the introduction of this crop.

Year	Quantity	Value
1910	12 191 kg	21 456 fr
1911	45 419	90 838
1912	194 211	388 422
1913	163 214	249 784
1914	117 364	186 902
1915	107 748	111 185
1916	173 576	271 379

During 1917, owing to the absolute lack of direct communication which has characterised the commercial traffic between the colony and the metropolis, there was only one single export of picked cotton weighing 1870 kg. worth 3 667 fr.

In the first seven months of 1918 the local exporters after succeeding in finding a sale for the New Caledonian produce on the foreign market, exported to Australia 2 619 kg., of picked cotton, and to Japan 83,022 kg., of the said product.

The variety of cotton cultivated in New Caledonia is *Gossypium peruvianum*. Before the war this variety was highly estimated on the market at Havre, where it was sold at a price advanced 30 to 50 % above the market price of ordinary American cottons. The average production on normal land is 1 ton of picked cotton per hectare but on good soil and with dependable crops the yield may quite well be doubled. It may also be stated that the port of Nouméa possesses two granaries for cotton, which deal with the produce harvested in the Colony and the imports from the New Hebrides.

Although the cotton cultivation had spread to such an extent in New Caledonia from 1910 to 1912 that the production showed a yield of from 12 tons to nearly 200 tons, it has since become almost stationary, and it is certain that it will have a tendency now to decrease.

It is not possible to value the annual production at the moment, at more than 100 tons,

The causes of this regression can be traced chiefly to the scarcity of manual labour, which, since the war, even more than before, exist in the Colony. Local mobilisation has, indeed, cleared off a large number of workers in New Caledonia.

It appears also that the Caledonian planters, after having shown at the outset a great partiality towards this form of culture, have to-day a certain tendancy to abandon this idea in favour of the older types with high profits, such as coffee and coprah.

The matter of cotton cultivation in New Caledonia is largely dependant then, on the supply of manual labour. It is certain that only when the planters in these countries will be able to secure a sufficient number of workers will cotton yieds increase to any marked extent.

Every part of the Colony, including the Loyalty Isles is equally in favour of this cultivation.

IX. New Hebrides. — In the New Hebrides archipelago, the cultivation of cotton, although even a more recent institution than in New Caledonia, appears to promise a very bright future.

The quality of the soil and the atmospheried conditions of the New-Hebrides achipelago, are apparently adapted in every way to this agricultural experiment, and what is more, it is certain that the difficulties connected with manual labour are less keenly felt than in New Caledonia.

The following table gives the quantities and values of the types of the New-Hebrides cotton reported at Nouméa since the establishment of commercial exportation at this port

This Table shows that the cotton cultivation in the New Hebrides continues to maintain marked progress, chiefly in Sants Island, and an average harvest of 500 tons for the years immediately following the war.

But even there, considerable improvements could be effected if some wise decision could be reached with regard to manual labour.

Year	Quantity	Value
1912	6 392 kg	12 784 fr
1913	77 243	126 541
1914	228 733	367 456
1915	352 697	463 825
1916	549 371	361 096
1917	105 898	204 379
7 months in 1918	402 802	1 006 504

Before the war, practically the whole Caledonian and New-Hebrides yield was sent to the metropolis, but owing to the poor condition of direct communications, a certain exportation method was obvious in connection with Japan and Australia. It is desired to re-establish as quick y as possible, the direct maritime relations with France so as to favour the metropolitain markets once again with the advantage of the cotton produced in French possessions in the Pacific.

Exportation facilities constitute one of the principal factors of intensive development in agricultural work in New Caledonia and the New Hebrides. Cotton does well in all the isles of the Archipelago.

X. Tahiti. — The Tahiti cottons are some of the best in the world. They are distinguished by their fine quality and the length of their fibres, and are much sought after for the fabrication of cotton embroidery or lace work. For a long time they have held the leading place on the London market, far out distancing their rivals.

Numerous trials have been made at various intervals, either by the administration of the Chamber of Agriculture, or by special Societies, to encourage and develop this culture in the French Archipelago.

But cotton cultivation has really been given up, and the Cotton Society itself, although it is true it has established a well supplied granary, is devoted exclusively to the coconut. There is no attempt made to plant additional cotton until the 35,000 coconuts at Faaron are in full bearing.

Two principal causes are conjointly responsible to a large extent for this abandonment of cotton cultivation in the Archipelago. Firstly, the high price of vanilla; and secondly the lack of manual labour.

At the present time vanilla culture has been more or less abandoned owing to the disease which harms this bindweed and the consequent diminution in value. As also the coconut continues to show higher value, it would probably mean that cotton cultivation could be restarted with some success and procure an appreciable yield to the farmers.

There are a large number of localites suited to this crop in these mountainous islands, on the coast line or plateaux that are as yet altogether uncultivated. The Islands Sous-le-Vent and Marquises show considerable opportunities for cotton planting, especially if Chinese manual labour is employed, peculiarly adapted to this form of culture.

Of however, any attempt is made in this respect, it les with the Cotton Society to take the initiative, since it was specially formed for this purpose and directed by an Agricultural expert who has made a special study in this branch.

XI. Guadeloupe. — At the present moment cotton cultivation hardly exists. It has been stopped in Guadeloupe, and in the Grande Terre for several reasons :

(1) lack of information with regard to this particular crop, and insufficiency of tools.

(2) high prices of sugar-cane as supplied to the factories and distilleries.

(3) mobilisation has weakened the strength of agriculture and industry. The majority of workers in the field were settled on land grants and not on extensive property. Manual labour was therefore scarce, and the few labourers obtainable required too high a pay to plant and harvest the cotton.

The districts where this culture can be instituted and urged forward are in the Grande Terre ; Anse, Bertrand, Canal, Moule, Saint-François. These are great sugar-cane producing centres, and the cotton cultivated is utilised in the manufacture of mattresses. In Guadeloupe : the southern part of Ballif. the dependancies : Marie-Galante, les Saintes, Saint-Martin and Saint-Barthélemy, give the practical total of the annual production. An extension of plantations would be possible in these islands.

In Guadeloupe, it is necessary :

(1) that the Cotton Society pass a fixed order for the negociants of Pointe-à-Pitre ;

(2) that the sale price be superior or at least equal to that offered in the neighbouring colonies.

As the cost price of cotton is determined by the run of the chief markets in Liverpool, Hamburg, and Havre, the preceding suggestion could be carried out if the buyers, the Colonial Cotton Association, the Colony or the State added a premium to the stated cost.

An experimental field should be established, with an agent specially appointed to instruct the planters, and to make a careful selection of the grains, the consignment of the best seeds (the cotton which will fetch the highest prices), and the distribution of small pamphlets on cotton will all help very much to the exten sion of this cultivation in the Antilles.

At the Experimental Stations, trials with machinery could also be made.

XII. CAMBODIA. — The *Bulletin de l'Association cotonnière coloniale*, gives the report that M. MARTIN DE FLACOURT (Chief of the Agricultural and Commercial Services at Cambodia) presented to the Colonial Agricultural Congress in Paris, 1918, on the "Possibilities of Cambodia for cotton growing. A résumé of this report was given in 1918 (1).

523 - **Agaves in Africa and Particularly in East Africa** (2). — I. HAUTEVILLE in *Journal d'Agriculture tropicale*, Vol. XIX, No 159, pp. 260-263. Paris, May 31 1919. — II. VUILLEUMIER R. *Ibid.*, No. 162, pp. 340-341, figs. 2 Paris, Nov. 30 1919.

I. The author refers to the articles in *Tropical Life* (3) 1918 on *Agave rigida* var. *sisalana* plantations, which cover a considerable part of East and West Africa (4) special attention is called to certain plantations on marshy land associated with one of the German companies (5).

The author has several times expressed doubts as to the possibility of cultural and financial success under such conditions. Having stated, in order to have the matter properly controlled, the absolute hasard of planting the agave on very dry land and in a very dry climate although admitting that this was less outstanding in the case of var. *sisisalana* than for var. *elongata* and less still for *A. Cantula* (6) and less still for *Fourcroya*, spp. he could not agree with the adventurous statement circulated by business men which had not yet been supported by any specialist. It is not whether a plant can thrive here or there, which the planter should consider, but whether it will keep all the qualities necessary for the justification of its cultivation on a large scale.

The author discusses the yields mentioned in *Tropical Life* (7) and takes the opportunity of comparing these yields, following the standard of the most leaves possible in the least possible time, (it appears that *A. sisalana* develops a flower stalk and dies in about 6 or 7 years in Africa) with the yields obtained in Mexico, where there is not such a good crop per year but where it lasts over a period of 20 years.

(1) Cottons of Cambodia and Indo China, general outline. — article by M. DE FLACOURT see *R.* Jan. 1919, nº 46 and *R.* May 1919, nº 595. (*Ed.*)

(2) See *Bull.* Apr. 1920, No. 421. (*Ed.*)

(3) See *Bull.* Aug. 1920, No. 904, and Jan. 1920, No. 36. (*Ed.*)

(4) The agave in the old German tropical colonies in Africa. See *Bull.* March 1913, No. 250. *Bull.* July 1915, No. 767; *Bull.* Oct. 1913, No. 1150; *Bull.* Jan. 1914, No. 11; *Bull.* Apr. 1914, Nos. 195 and 300. (*Ed.*)

(5) See *Journal d'Agriculture Tropicale*, No. 69, March 1907. (*Author's note*)

(6) See *Bull.* Feb. 1920, No. 203.

(7) See *Bull.* Jan. 1920, No. 46. (*N. of R.*)

The average yield obtained, as reported for 1 year, is higher in the second case than the first.

On the other hand, the author notes that to cut after 3 years has always been considered premature ; the agave has then a supple, fine and silky fibre, but non-resistant, and the vigour of the plant suffers from this premature operation.

African agave plantations are scarce because the climate and soil are neither of them suitable, because they are worked too soon, and perhaps improperly, as it is to be feared that the planters do not allow a group of 22 to 22 leaves to remain on each stalk to maintain its vigour.

The author. with reference to an assertion made by HERSON that the examples of stock proceeding from suckers is strictly limited to that of the parent plant, says that it is the first time such a thing has been. notified, and he declares that he possessed at La-Pho (Tonkin) various agave stalks which are 5 or 6 years old and come from suckers rising from the parent stalks ready for sending up their flower stalks, the signal of their approaching death.

II. — As a result of the article by M. LEON HAUTEVILLE (1), the *Journal d'Agriculture tropicale*, received from M. René VUILLEUMIER, Agent-Consular of France at Quelimane and Director of the " Empreza Agricola do Lugella " a note in which the author describes the experiments. On the land in question, the *Agave rigida* var. *sisalana* produces its flower stalk after about 5 ½ to 6 years. The cutting can be begun about the 3rd year, and carried on then under normal conditions for 2 ½ years. Each year a healthy plant gives from 60 to 80 leaves, average weight 700 gm., making an average total of 175 leaves per plant. The fibre yield is from 3 to 3 ½ %.

On marshland, there is no hope of success.

On the plantations, the spacing is 2 × m. or 2 × 2 m. The first arrangement is preferable for intercropping, which is practised for the first two years ; the first year with cotton, the second with maize.

Experience shows that, to establish a plantation it is wiser to plant out after a year in the nursery. Plants from suckers do not develop so well, and may have a shorter life (by 2 or 3 months) than those from bulbils, but it is quite out of the question that these plants may have an existence limited to the same extent as the parents ; it is pure imagination, and the author has personally undertaken various experiments wich have given altogether negative results. On the province, a plantation of about 150,000 cuttings was made in January 1915, and taken from suckers from parent plants which had only lasted until the end of 1915 ; not one of these plants had produced its flower stalk at the end of 1919. The plantation of the " Empreza Agricola do Lugella " has at present 4 millions of cuttings with 2 millions of bulbils in nurseries.

(1) On " Textile Agave at Tonkin ". See work of M. L. HAUTEVILLE which appeared on the title of the *Congrès d'Agriculture coloniale*. Government general of Indochina. Series Hanoï No. 3, Hanoï-Haïphong 1918. Mentioned in *R.* Febr. 1920, No. 203, Note 4. (*N. of R.*)

524 – **The Dwarf Coconut in the Federated Malay States.** — HANDOVER W. P., in *The Agricultural Bulletin of the Federated Malay States*, v. VIII, nº 5, p. 295-297. Kuala Lumpur, sept.-oct. 1919.

The increasing rise in the price of copra having given renewed activity to coconut planting in this country, it is important that some facts of this interesting variety of coconut should be put on record.

Description. — The dwarf coconut known in this country as « nyiur gading » is remarkable for its early fruiting palms only 10 feet high, bearing abundant fruits touching the ground. The young palm grown under good conditions starts to flower in its third year and produces ripe fruit in about nine months from the appearance of the flower spike. The initial flower spikes contain only male flowers, but other spikes occurring in rapid succession, are larger and bear an increasing number of *female* flowers one spike from a six-year-old tree bearing 200 young *female* flowers, whilst trusses of fruit from similar trees have been found with as many as 55 ripe nuts.

The dwarf coconut is generally of a bright yellow colour. There is besides, a distinct brick-red variety, also a green variety and a number of intermediate colours which might be ranged as ivory yellow " gading ", golden yellow, orange brick red, green bronze, and deep green. The flower spikes, leaf bases, and leaf ribs, correspond in colour with the fruit, giving the compact trees a very handsome appearance. Again there are semi-tall trees of these different colours, which are later coming into bearing, have slightly larger nuts, and are less prolific than the true dwarf.

The dwarf yellow strain appears as the most prolific, whilst the other varieties vary proportionately in their productiveness and also in the shape and size of the nut and are evidently the outcome of cross fertilization from original types or " mutants " (1).

The different varieties are distinguished amongst the Malays and Javanese under particular names, such as " nyur ", " (klapa) gading ", " k. merah, (or sàjah) ", " k. kapak ", " k. pisang ", " k. puyok ", " k. hahi ", " sepang and, " k. nipah ".

A full grown leaf of the " nyiur gading " measures only 12 feet from base to tip, whilst the ripe nut measures 22 ½ in. × 24 and the stem 24 inches in girth, the nut has an average amount of fibre, a thin shell, and proportionately with the big nut, a good thickness of white kernel.

This " meat " is said by the Malays to be richer in oil and sweeter in taste than that of the big coconut and it is therefore very popular with them for domestic purposes.

History. — In spite of diligent enquiry it has not been possible for the author to find out the definite origin of this dwarf nut, but it seems first to have occurred as a " sport " or " mutant " probably in Java. Trees,

(1) Certain curious variations have been observed in the coconut tree: see nº 514 of this *Review*. (*Ed.*)

thirty years old or so, occur in different parts of the peninsula and many of these still bear abundantly.

In 1912, 500 acres were planted with these dwarf nuts at Sungei Nipah Estate on the Coast between Port Dickson and Sepang Point and this is probably the only estate of dwarf coconuts in the world.

Growth. — Like all coconuts, this dwarf form appears to be exceedingly hardy, growing well either in white clay, red loam, or deep peat, in fact it seems to thrive in any situation where water is abundant, yet not stagnant, though it is evident that well drained alluvium suits it best.

In such a soil six-year-old palms have been counted with 234 nuts (excluding ovules), and the trees average 80 nuts a year.

Crop. — In the first year of production at Sungei Nipah the crop over 225 acres was 102 000 nuts whilst the second year it was 574 000 nuts and the third year it will probably be nearly a million; from which the author considers an average yield for dwarf nuts may be estimated as follows:

At the end of 4th year	=	1st	yielding	year	10	nuts per tree	
5th	»	2nd	»	»	30	»	
6th	»	3rd	»	»	60	»	
7th	»	4th	»	»	80	»	
8th	»	5th	»	»	100	»	
6th	»	6th	»	»	120	»	(in full bearing).

These estimates in face of yields from individual trees will appear conservative, but there are many points which have to be considered when dealing with *average* yields, and no doubt under ideal conditions a much higher average could be obtained.

In making *copra*, it has been found that the nut from a young tree is smaller than that forming later, and its kernel likewise thinner, whilst of course, on heavy yielding trees the nuts are a little below the average in size, but 500 nuts to a pikul (1) of copra is a general average, which would be decreased somewhat later as more even nuts with thicker "meat" are obtained. With the leaf length only 12 feet it was found convenient to plant the palms 24 ft × 20 ft which gave 90 to the acre, a number nearly double to that required when planting big palms.

It is evident therefore that with this planting we should get, say, in the fifth year of planting 90 × 30 nuts = 2700 nuts per acre $= \frac{27}{5} = 5\frac{2}{5}$ pikuls copra per acre. Likewise, in the ninth year 90 × 120 = 10 800 nuts per acre $= \frac{108}{5} = 21\frac{3}{5}$ pikuls copra per acre. Comparing this with the big coconut which does not produce till *after* its fifth year it might be estimated as giving in its ninth year 45 trees at 40 nuts = 1800 nuts per acre $= \frac{1800}{220} = 8$ pikuls of copra per acre. With the dwarf trees there is the great advantage of easy and rapid picking,

(1) 1 pikul = 133 1/3 lb.

and inspection for beetles and other pests, though of course in manufacture almost 2 ½ times the number of nuts per pikul of copra handled, but this is not of so great a consequence when working with newly devised methods and machinery, dealing with large quantities.

The profit per acre from five-year old dwarf coconuts to-day can even stand comparison with that of rubber, and the man who is planting to-day, has to consider markets five years a head and might do worse than place confidence in the dwarf coconuts.

525 - **Utilisation of the Fruits of *Melia Azedarach* as a Source of "Mangora" Oil.** — De Wildeman, E., in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year IV, 1919-1920, No. 27, pp. 74-77. Paris, November-December, 1919.

Following on the article (1) by M. L. Rigotard (which appeared in the same publication) on the possibility of using the fruit of *Melia Azedarach* L. as a source of alcohol, the author quotes other ways in which this fruit can be utilised and certain uses for the plant itself.

The author collected, in 1903 and 1905, the scanty data available on the uses of the various parts of this plant (2), especially as regards the fats, and published them in one of his works.

Melia Azedarach, known in the Belgian Congo as "Lilas des Falls" is not, as has been thought, a native of Africa, but has been introduced, as has happened in most tropical and subtropical regions. It is a tree which may reach 30 ft height, with a short, upright trunk, and a wide crown that bears clusters of white flowers with a violet tinge. Its wide distribution, largely through human agency, has led to investigations on its pharmaceutical value, which may possibly be of a certain importance.

The plant, also known as the Persian lilac, or bead tree, grows very rapidly, even in poor soils ; its is, however, very sensitive to constant damp, as its roots rot easily. At an age of 4 or 5 years, the plant is from 20 to 23 ft. high, 1 ft. 6 in., in circumference, and bears fruit and flowers throughout the year.

The author cites a research carried out by M. J. Ondenampsen on the chemistry of this plant, and in which the properties attributed to it almost everywhere are described (3). According to him, the fruit can yield, on expression, 50-60 % of a dirty yellow fat, which liquefies at about 35° C, and rapidly turns rancid. This oil, known as "mangora" oil, can be used for soap-making, lighting, painting, and in medicine.

According to Fendler, the fat content of the pulp is too small (2 %) to allow this part alone of the fruit to be used ; the seeds contain more (39.36 %) ; in proportion to the whole fruit, the content is 4.62 %. To

(1) See *R.*, July-Sept., 1919, No. 983. (*Ed*)

(2) De Wildeman, *Notices sur les plantes utiles ou intéressantes de la Flore du Congo*, Brussels, 1903-1906, pp. 42 and 486. (*Ed.*)

(3) J. Ondenampsen, *Bydrage tot de kennis can Melia Azedarach* L. Utrecht, 1902.

make exploitation economic, the pulp would apparently have to be separated, which would require considerable labour.

These two opinions, therefore, do not agree.

FENDLER also considers that this oil could not be used as human food, but says that it could be used in the manufacture of varnishes, while repeating that its extraction is not commercially possible.

The green fruit has been used in Texas for making boot-polish, and in Georgia, after fermentation and distillation, for making a kind of whisky said to be superior to alcohol made from wheat and rice, although the fruit is reputed to be poisonous. However, the fruit is eaten without ill-effects and even with eagerness by goats and sheep.

Besides the medicinal use of *Melia* and its possible industrial utilisation, the wood is of a certain value. The wood is of a whitish or pinkish yellow colour and is hard and resistant ; the annual rings are brown and give fine veining ; the grain is close and fine and gives a good polish with pleasing reflections. The wood can be used for joinery or cabinet-work ; it is much in demand in China and Japan for the manufacture of musical instruments.

Some authors consider this wood to be of little value ; in Martinique and Guadeloupe it is said to be soft, brittle, and only good for firewood.

Two varieties are reported from Indo-China, the " Koan Ha ", with reddish wood, and the " Koan Trang ", with whitish wood, both prized varieties, especially for their resistance to the attacks of termites.

It has been suggested that Melia should be used for replanting land unsuitable for cropping, and then delicate plants, such as coffee, can be grown under its shade.

The seeds germinate easily, and the young plants can be transplanted quite well when 12-14 in., high.

This plant, then, mainly grown for ornamental use (flowers), is worth the attention of planters for other reasons.

But conflicting opinions have been expressed above ; the author stated some time ago that certain characters of the oil and the name of " Maryosa " oil probably belonged to the products of another species, *Melia Azadirachta*; so that certain authors, e. g., LEWKOWITCH, may possibly have confused *Melia Azedarach* with *M. Azadirachta*.

These contradictory data should be cleared up by research and, above all, the correct botanical name of the plant should be ascertained.

526 - **The Seeds and Oil of " Eno Abura " (*Perilla ocymoides*) from Japan.** — See No 584 in this *Review*.

527 - **The Utilisation of *Acacia decurrens* in India.** — MACKENZIE, C. E., in *Science and Industry*, Vol. I, No. 7, pp. 430-432. 3 fig. Melbourne, November, 1919.

Much progress has been made in South Africa in the utilisation of the Australian acacias, especially *Acacia decurrens*, for the preparation of industrial tanning extracts. Like the Australian eucalyptus, which is grown on a large scale in various countries such as California, Italy, and India,

where it is more highly valued than in its native country, the Australian acacias have attracted much attention in South Africa.

The author is connected with an enterprise which intends to start a plantation of *Acacia decurrens* in India, to utilise the tree for the production of tanning extracts for the Hindoo tanneries and to supply acetic acid for coagulating rubber latex, for the manufacture of explosive and other products such as methyl alcohol, formaldehyde (obtained by distilling the wood) and brown paper (from the bark after the tannin is estracted).

A 250-acre experimental plantation, situated at an altitude of 7 500 ft. under the tropics, in the Nilgiri Hills (S. India) is now growing. In order to obtain more rapid growth and to obtain a greater area of jungle on which to plant the crop, new land concessions have been obtained in the Wynaad plateau, at an altitude of 3000 ft. on the same latitude (11° N.). The annual rainfall amounts to 2.815 metres a year, and the temperature varies between 60°-105° F (15 50°-40 56° C). The Government has granted 6 000 acres free of taxes for the first 5 years, after which period, taxes will be paid on the area not brought under cultivation. The trees can be barked after 5 years' growth.

Plantation consists in putting 2 or 3 seeds of *A. decurrens* in holes spaced 6 × 7 feet apart, which gives 1000 trees per acre. From results obtained at the experimental plantation in the Nilgiri Hills, the yield of bark is 25 000 lb. per acre, and of green wood over 100 tons per acre.

The results of analyses of the bark and distillation products obtained from wood from the above-mentioned experimental plantation are given below.

Leather Industries Laboratories.

London, Sept. 14, 1917

Tanning material absorbed by skin.	42.3 %
Soluble non tannins	10.8 »
Insoluble matter	34.1 »
Water	12.8 »

Indian Institute of Science.

Bongalore, May 15 1919.
(Calculated on 100 lb. of wood.)

Free moisture in wood	7.7 %
Charcoal	32.0 »
Tar	9.0 »
Total acetic acid	5.58 »
Methyl alcohol	1.43 »

RUBBER, GUM AND RESIN PLANTS

528 – **Present State of Camphor Production: Experiments on Growing the Camphor Tree.** — CAYLA, V., in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Ser., Year IV, 1919-1920, No. 28, pp. 97-109, 1 plate. Paris, Jan.-Febr., 1920.

Amongst the raw materials utilised by Western industry, and which have to be entirely imported, camphor attracts notice on account of the rapid and heavy increase in its price, especially in 1919.

Prices remained normal until 1915, and at the end of 1914, they were still at 4.25 fr. per kg. The successive stages of increase in prices during subsequent years were as follows (1):

Variations in the price of camphor, 1915-1918.

		fr.		fr.		fr.
1915	—		June	4,60	Decembre	6,25
1916	March	5,15	July	6,00	Octobre	8,50
1917	February	10,00	June	9,25	»	10,50
1918	February	16,50	July	15,50	»	25,00

Year 1919.

May	32,00 fr	August	50,00 fr	November	70,00 fr
June	38,00	September	55,00	December	80,00
July	45,00	October	57,00		

Part of the increase in 1919 is obviously due to the depreciation of the franc on the world's market. All the same, there is an enormous increase in price.

Japan controls the world's camphor market, and, on account of the increased consumption of camphor in Japanese industry, the exports of camphor from Japan have decreased, thus causing a crisis in the European celluloid industry.

If France in particular does not wish to have to buy crude or even manufactured celluloid, she will either have to produce synthetic camphor or exploit the camphor laurel.

There are many processes for producing *synthetic camphor*, even if the quite different material known by chemists as *artificial* camphor be not included, as it cannot replace natural camphor in its industrial uses. But the only processes worth industrial exploitation require terebenthine oil as a raw material, and the industry making the synthetic product, which, owing to the high price of the natural product, established in 1907, was not able to carry on, on account of the high price of turpentine and the drop in the price of natural camphor. Nowadays, the establishment of factories is a costly and lengthy process. Most of the processes, only worked out on a laboratory scale, would require time to perfect their industrial application, and no speedy solution of the camphor crisis in expected in the manufacture of the synthetic product.

Exception being made of the many plants that produce camphor in small amounts, the Japanese camphor tree (*Cinnamomum Camphora* Nees), of the Lauraceae family, is the only plant that has been and remains the type of plant that can be exploited industrially. This is a tree occurring in large numbers in the forests of the Japanese archipelago, Formosa, Hainan, central China, and the province of Fokien (China). Practically the whole of the 6000 tons of camphor which represents the maximum

(1) These figures, furnished by M. L. Michel, President of the " Syndicat général de la Droguerie française ", répresent the value in francs per kg. of refined camphor. (*Author*).

annual consumption was and is obtained from these regions. Exploitation consists in felling trees at least 40-50 years old ; the wood is reduced to chips, from which the camphor is extracted by distillation in a current of steam. The crystals of crude camphor which are deposited in cooled recipients are pressed and finally refined in special refineries. A liquid, known as "oil of camphor", is also collected and constitutes an important by-product.

This method is obviously crude and is leading to a rapid destruction of the forests, even if officially controlled. China, with its continental provinces, and with Formosa, was for a long time as important as Japan as a source of camphor. The cession of Formosa to Japan gave that country all the insular production, which was at once made into a State monopoly, not only as regards the exploitation of the forests and the extraction of camphor, but also as regards its refining and sale. The sale price is fixed by the State, whose representatives buy the crop from the producers at a price which is fixed anually. To prevent any competition from China, Japanese commerce has made itself absolute master of the Chinese camphor, exported chiefly through Shanghai, Foo-Chow and Amoy. By raising or lowering the price of camphor, Japan stimulated or discouraged the exploitation of the Chinese forests, over which there is no control. In fact, Japan is the absolute master of the Far-Eastern production, and therefore of the world's consumption, as practically all the camphor consumed in the world comes from the Far-East.

Experiments have been carried out for years on the extraction of camphor from the leaves and young branches of younger trees, which thus would not be killed. Eight or ten years ago, it was said that, as a result of encouraging experiments, Japanese technicians placed all their hope in the extraction of camphor from the leaves. In 1913, and again in 1919, it was reported that these hopes were not fulfilled and that the Japanese relied solely on the synthetic camphor that they were going to make. However, for the last 10 years, the Japanese production of camphor has not decreased — the preceding figures show it — and one is forced to the conclusion that either the forests were not as exhausted as they were said to be, or that camphor was extracted from the leaves, for the author rejects the hypothesis that synthetic camphor was manufactured in the archipelago and sold as natural camphor.

Exploitation by felling the trees and distilling the wood can only be carried out in the Far East, as old forests of *Cinnamomum Camphora* are found nowhere else. In the other tropical and sub-tropical countries into which the camphor tree has been introduced, all that can be done, if the tree is cultivated, is to distill the leaves and young branches. As regards this, all the information that Japan has furnished is that the yield is too small to be of interest. The author reviews the experiments that have been made in various countries on this subject.

The yields of camphor obtained in these experiments were very variable, for various reasons. Firstly, in the distillation, certain of the methods give rise to losses, and then the percentages refer now to the weight

of fresh matter, now to the weight of dry matter. In the latter case, there are variations according to whether the drying was natural or artificial, in the sun, or in the shade, under one climate or under another. Many of the results take no account of the camphor oil, which is a solvent of camphor. The content of camphor varies according to the season, the temperature, the age of the tree. All these varations occur in material from one tree. Also there are various botanical species or varieties of camphor tree, with varying contents of camphor. Even in Japan, FESCA has recorded 3 varieties, each with a different content. The camphor trees in Indo-China which, according to CREVOST, have been introduced, as they are found in the forests only around the pagodas, apparently belong to several distinct species. There is the "true" camphor-tree, which yields camphor, and the "false" camphor-tree, which does not. Amongst specimens sent from Tonkin, DUBARD found *Cinnamomum Camphora* and *C. cecidodaphne* var. *caniflora*. Amongst Italian camphor-trees, Prof. GIGLIOLI identified *C. Camphora*, *C. glanduliferum* and their hybrids. Dr. TRABUT has shown that HARDY'S camphorless camphor-tree, in the Algiers Botanic Garden, was not *C. Camphora*, but a hybrid, and analyses made by L. MUSSO (1913 and 1919) confirm the supposition that a difference in content corresponds to a specific difference. It was found at Kew that the old camphorless camphor-tree (it only yields camphor oil) of the Botanic Garden of St. Vincent was *C. Camphora* var. *glaucescens*. However, the camphor trees in Mauritius, which only yield camphor oil — very different from the product sold under that name — really do belong to the species *Cinnamomum Camphora*.

It has been mentioned that often no account is taken of the oil of camphor produced and that it was rare to find its content of crystallisable camphor given. All the same, this is a point that should not be neglected when estimating the total yield of camphor from a tree.

In any case, the oil itself, freed from dissolved camphor, is of interest, for, on fractional distillation, it yields two valuable products: *safrol* and, in smaller amount, *eugenol*. Here again there are variations, as camphor oil yields more or less of safrol or of eugenol, or nothing of one or the other, without it being known if these differences are due to the influence of the environment or of the botanical origin.

All this shows how much research is still required on the camphor-tree, its cultivation and exploitation, on botanical questions, etc.

The unit yield also must be calculated. This depends on the age of the trees, the number and extent of the cuts given them, the period during which the cuts were made, the method of planting (number of trees per hectare), etc. LOMMEL, according to AMANI'S experiments, estimates that, with 2 annual cuts, a yield of 145 kg. of camphor and 46 kg. of camphor oil per hectare can be obtained. According to S. C. HOOD and R. H. ERIC, trees 2.5 metres high, planted 4.50 metres × 1.80 metres, with two annual cuts, will give from 200-225 kg. of marketable camphor per hectare per year. Other figures have been calculated but it is difficult to say that they are definitive.

But, though RIVIÈRE has declared that the camphor-tree will not bear cutting, even if only repeated once every two years and over half the tree, most English experts state that its is not harmed, that its growth is not affected by one, two or three annual cuts according to its age, each cut affecting ⅓ of the foliage at most.

The objections to this method of exploitation are mostly of an economic nature. Prof E. W. HILGARD say that, in California, this crop cannot be grown on account of the high cost of labour. CH. RIVIÈRE also states that removing the leaves would be difficult and expensive and that at any rate in Algeria the tree could not be exploited before the age of 25 years. Most British or American workers give 4 to 8 years as the age at which exploitation can begin. However, this point requires investigation.

The author thinks that researches and experiments should be carried out in the French colonies. In Indo-China, there are camphor-trees that could be exploited and multiplied. In most of the French possessions, including North Africa, experiments could be carried out, and practical cultivation experiments are necessary in all those colonies.

SUGAR CROPS

529 – **Action of Heat on Sugar-Beet Seed.** — SAILLARD, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 11, pp. 308-311. Paris, March 17, 1920.

Acting on the suggestion of the Official Sugar-Beet Seed Commission, the French Ministry of Agriculture has opened a competition for apparatus for drying beet seed. The competition will take place in March, 1921, and two prizes, one of 30 000 fr. and one of 20 000 fr., are offered.

The object of drying is to improve the keeping and germinating qualites of the seeds. According to M. SCHRIBAUX, beet seed can be kept at a temperature of 70° C for several hours without being harmed. The conditions of the competition make allowance for this observation.

The author has investigated the action of temperatures above 70° C. on the vitality of the glomerules, comparing them with temperatures below 70° C. The experiments, in which M. WEHRUNG collaborated, bore on seeds of varying quality and age. The seeds were heated in an oven with a thermo-regulator, a closed oven in which the air could be changed, or in an ordinary oven ; the seeds were not shaken during heating. Germination was carried out on damp sand in an oven kept at 25° C. The germinated glomerules were counted each day and those that had not germinated at the end of 22 days were assumed to have been killed.

1st series of tests. — Seeds of 3 qualities, very good (*A*) good (*B*), bad (*C*), showing respectively after 14 days, a germination coefficient of 98 for *A*, 78 for *B*, 36 for *C*, were respectively heated for an hour at 40, 50, 60, 70, 80, 90, 100 and 105° C, then germinated at 25° V, for 22 days in parallel with unheated controls. Some of the results obtained are given below.

It is evident that, the good seeds germinated more quickly and resisted the heat better than the poor ones.

2nd series of tests. — The same seed *A*, *B* and *C* were heated for ¼

½, ¾ and 1 hour, respectively, at 80°, 100° and 105° C, then germinated at 25°C, in conjunction with unheated controls. The appended table shows some of the results obtained.

After	Unheated control	Number of glomerules germinated out of 100 heated at for one hour at					
		60° C.	70° C.	80° C.	90° C.	100° C.	105° C.
Bad seed (C)							
3 days	0	0	0	0	0	0	0
6 days	27	28	27	0	0	0	0
14 days	36	36	37	9	2	0	0
18 and 22 days	36	36	37	9	2	0	0
Good seed (B)							
3 days	61	68	10	0	0	0	0
6 days	84	88	75	50	3	0	0
14 days	87	89	86	86	74	42	0
18 and 22 days	87	89	86	86	75	46	0
Very good seed gathered in (A)							
3 days	95	94	90	54	5	0	0
6 days	97	98	97	97	95	70	1
14 days	97	98	97	97	95	80	3
18 and 22 days	97	98	97	97	95	80	3

Duration of heating	Number of glomerules that germinated in 14 days								
	Seed A			Seed B			Seed C		
	80° C.	100° C.	105° C.	80° C.	100° C.	105° C.	80° C.	100° C.	105° C.
15 minutes	97	94	12	86	65	4	25	18	0
30 »	97	91	8	86	55	0	18	10	0
45 »	97	86	5	86	45	0	11	0	0
60 »	97	80	3	86	42	0	9	0	0

The germination coefficient continued to increase until the 18th day with regard to the heated seeds which, after 14 days' germination, had given a lower germination coefficient than the 2 controls, but without reaching it, even after 22 days.

It should be added that seed *A* was gathered by hand, as it gradually matured, and was at once dried in the sun. This is probably the explanation of its very high germination coefficient.

Conclusions. -- (1) With properly applied heat, the bad or weak glomerules can be killed, without harming the good or strong ones. It is therefore, a physical means for selecting the glomerules.

(2) A temperature of 80° C, even when maintained for an hour,

did not alter the germination coefficients, after 14 days, for seed *A* and *B*; but it somewhat retarded their germination.

As the germination test was done immediately after heating, the preceding results simply show the action of heat on the vitality of the seeds, but not the action of the heat used for preserving the seeds.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

530 – **Loss in Dry Matter of Kentucky Tobacco at Different Periods of Drying.** — Donadoni, M., in *Bollettino tecnico del R. Istituto sperimentale del Tabacco, Roma-Scafati (Salerno)*, year XVI, No. 2, pp. 17–81. Scafati, October-December, 1919.

It was found that the average total loss of organic matter undergone by Kentucky tobacco during drying by direct heat was about 16 %. About $^2/_3$ of the loss took place in the first period of drying, i. e., that which corresponds to the yellowing of the leaves. As regards the importance of the changes that take place in the tobacco leaves during drying, by far the most important period is that of yellowing. The essential factor of the changes during the first period of drying is the vitality retained by the leaf after it has been detached from the stem, or after the stem (when the plant is dried) has been separated from the roots. In fact, the disappearance of the yellow colour and its replacement by a chestnut colour, indicate the complete physiological death of the corresponding tissues. For this reason, the chief elements that help to making the drying of Kentucky tobacco a success include : — The perfect state of the leaf tissues at the moment when drying commences ; the gradual and complete change in colour of the leaf from green to yellow, which shows that all the important changes correlated with the first drying period, (changes which go hand in hand with the change in colour of the leaf) have taken place.

VARIOUS CROPS

531 – **Utilisation of *Melia Azedarach* as a Shade Plant in Coffee Plantations.** — See No. 525 of this *Review*.

VINE GROWING

532 – **The Resistance of Various Stocks to Drought.** — Sicard, in *Le Progrès agricole et viticole*, Year XXXVII, No. 11, pp. 256-262. Montpellier, March 14, 1920.

Communication to the "Société centrale de l'Hérault" (France), describing observations made on experimental vines during the summer of 1919, which was exceptionally dry. The author does not consider the nature of the soils, as they are dry on account of the bad constitution of their soil or subsoil, and only deals with soils which, in certain years, dry up, after climatic misfortunes like those from which most soils in the south of France suffer.

The replacement of worn-out vines or those prematurely ruined by lack of care, becomes a necessity which cannot be indefinitely postponed. Hindered or stopped by the war, reconstitution will soon recover its progress towards an ever more intensive production. To this end, the judicious choice of grafting stock is of great importance. The scientific study and practical testing of different varieties should provide rational and natural means for recognising foreign influences, especially drought, that act on the qualities of American vines and their hybrids. With an

environment whose geology, physics and chemistry is well known, it should be easy to provide solid foundations for such new reconstitution, and thus the improvement of the soils would be as complete and perfect as possible.

In the deep, strong and calcareous soils that were studied, the grafting stocks that best resisted intense and prolonged drought were the hybrids of Vinifera × Rupestris, which were clearly better than the pure Americans, the Americo-Americans, and even the Vinifera × Berlandieri. In these soils, Berlandieri hybrids did not give the favorable results obtained on shallow, dry soils, and the author adds that the resistance of a stock to drought is characterised:

(1) By a perfect adaptation of the root system to the physical properties of the soil and subsoil.

(2) By numerous thick, fleshy roots, which form a powerful apparatus for absorption.

(3) By reduced foliar development, thus limiting the evaporation capacity of the stomata.

533 - **The Bahaviour of Grafted Vines and Direct Bearers in Relation to Drought, in Touraine France.** — See No. 448 of this *Review*.

534 - **The Layering of Grafted Vines.** — ROSEAU, H., in *Revue de Viticulture*, Year XXVII, Vol. LII, No. 1340, pp. 161-16. Paris, March 4, 1920.

Layering is a method of reproduction which consists in obtaining roots on a vine-shoot before it is separated from the parent plant, the shoot afterwards becoming a separate plant. To do this, the shoot is bent over and buried in a hole some 30 cm. deep. In Champagne, Burgundy and the Saumurois district, the method employed is as follows: the shoot is never separated from the parent plant, and generally the whole plant is buried, leaving only two shoots, one at the original spot and the other at the place where it is wished to obtain a new plant; sometimes, instead of layering one plant but once, it is layered in successive years; from the plant *A* two new plants are obtained, *B* at the original place of *A*, and *C* a little farther away; the next year *C* in turn is buried and treated like *A*, and so on; this practice is known as "assiselage".

With regard to the possibility of applying layering and "assiselage" to French vines grafted on American vines in spite of the attacks of phylloxera, the author discusses the arguments for and against this method, quoting experimental evidence of long standing and then gives his personal opinion as follows:

When the numerous positive results obtained in several French vineyards are considered, it may be concluded that there is no need to give up layering grafted vines. It has many advantages for the vinegrower and it is a practice that is well worth extending. Naturally there were failures in Champagne or elsewhere, but these were mostly due to indirect factors such as mildew, chlorosis, etc., when they were not the result of incompetent practice.

If failures are to be avoided, the following rules must be observed: Parent plants must be chosen that are at least 4 years old, so that

they have a vigorous root-system. The plants must be vigorous and healthy, the graft callus must be healthy and well formed, and the shoot chosen for layering must be healthy and strong.

In spring, before growth starts, the stock must be cleared of soil down to the first roots, a small ditch 25 to 30 cm. deep must be made in the direction in which the shoot is to be laid and the stock bent over on the side to which it inclines naturally. Care must be taken not to break it or damage the roots.

Finally, when the shoot is fastened down, the part that joins it to the parent plant must not be cut, as there should always be a vital connection between shoot and plant. Care should be exercised that the layering is not harmed by ploughing or other work that might damage the buried shoot. Vinegrowers should test the method in their own vineyards, e. g., in layering to replace missing trees, and this would be the best way to form a personal opinion and ascertain the value of the method.

FORESTRY

535 – **Planting Trees on Waste Heaps, Abandoned Quarries and Land in Belgium.** — CRAHAY, N. I., in the *Bulletin de la Société Centrale Forestière de Belgique*, Year XXVII, No. 3, pp. 117-131. Brussels, March, 1920.

In Belgium there are many sterile areas, heaps of stone, shale, virgin soil, ashes, accumulations of industrial or public refuse, slag banks, abandoned quarries, excavations or dumps made in the construction of railways, roads, etc., which form ugly blots that may spoil the finest landscape, and which could with advantage be planted with trees or shrubs. The author thinks that there is much to be done as regards this matter that would greatly benefit the health, the beauty of the country and, up to a certain point, the production of wood.

There is hardly any soil that cannot be overgrown by trees in time. Obviously, certain dumps of refuse or stone may be abandoned provisorily, but, after a certain time, the action of air and weather takes effect, subsidence takes place, the rocks are decomposed and soon a little soil is formed on which the vanguard of plant life can be established. Three cases can be met with:

(1) Dumps where refuse is still being deposited.

(2) Dumps or parts of dumps where combustion is taking place, as is shown by smoke, heat, or by the scorched appearance of the surrounding vegetation.

(3) Large heaps of rocks and stone with wide cracks, and which have not weathered sufficiently.

In England, waste heaps have been planted with trees for some time now and an association with over 500 members was formed for that purpose. In Belgium, the industrialists and quarry owners were quite free to change the appearance of a district and to destroy the most beautiful places which sometimes bring prosperity and riches, until June 30, 1905, when MM. DESTRÉE and CARTON DE WIART put forward a Bill for the preservation of landscapes. This Bill was favourably received during the Parliamentary session of 1911 and, after interesting debates in the Chamber and Senate, it became law on August 12, 1911. The text is as follows:

Art. 1. — Any person exploiting mines, excavations, or quarries, or any contractor for public works, must, as far as is possible, restore the appearance of the soil, by planting the excavations, heaps, etc,, with trees or other vegetation that will remain permanently. Planting must be carried out as each portion of the work is finished.

Art. 2. — In case of non-compliance with Art. 1, the person can be charged so. The action will take place in the Court of the first instance of the devastated district at the request of the king's Proctor.

It will equally affect any Belgian citizen. In case the work is not carried out within the time fixed by the Court, it will be done officially at the expense of the person exploiting the mine, etc., or owning the concession, by the Ministry of Agriculture and Public Works.

Art. 3. — This law applies to the State, Provinces, and Communes, as well as to private enterprises.

So far, this law has remained a dead letter and no steps have been taken to carry it into effect. This state of affairs will continue until the State has it carried out by the Service of Waters and Forests. Suggested measures which might be adopted are :

(1) Refusal of permission to open mines, quarries' to establish industries, to construct railways and roads unless guarantees are given regarding the site and the subsequent planting of areas that have become unproductive, heaps, excavations, dumps, etc. The deposit of surety-money may, in certain cases, be required, so as to provide for the necessary work. In 1894 and 1897, the Belgian Minister, M. DE BRUINS drew the attention of the Governors of provinces and of Forestry Inspectors and ordered that when requests for permission to open quarries, mines, etc., were made, greater attention should be paid to the question, of the landscape.

(2) To act by giving advice to industrialists to show them their duty as well as where their interest lies, for if they profit from an exploitation it is incumbent on them to allocate a small part of the profits to repair the harm they have done to everyone spoiling a landscape. as well as to make the place where their employes live more agreeable and healthy.

(3) To provide owners with land requiring planting with the help of persons competent to direct the work or forest officers.

(4) To give cash subsidies or grants in certain cases.

(5) Purchase by the State or communes, of the areas in question when they are decidedly of general interest and when reasonable terms can be obtained. This is evidently the ideal and the site would be permanently preserved.

Many broad-leaved trees do well on pit banks and quarry tips. Remarkable results have been given by the robinia, great round-leaved sallow, white alder, birch, Virginian cherry, maple, wild cherry, service-tree, beam-tree, lime, chestnut; and, under the best conditions, such as at the foot of the slopes, maples, elm, oak, ash, hornbeam, and even the Canadian poplar.

As regards mixtures, the trees should be varied according to the district, the exposure, slope, nature of the materials, but, following the usual practice in making plantations of broad-leaved trees, the species should be divided in two broad categories :

(1) Trees of rapid growth which resist exposure, bad weather, and produce shelter and soil in a short time and thus enable more exacting but often more valuable trees to be planted. This category includes the robinia, white alder, great-leaved sallow, birch, lime, service-tree, beam-tree and Virginian cherry.

(2) Trees of slower growth which take longer to become established and which like a little shelter and coolness, with which the trees in the first category can provide them ; these include the elm, chestnut oak, hornbeam, maple and ash. As a rule, trees belonging to the first class should constitute from 1/5 to 2/5 of the mixture.

In conclusion, it is eminently desirable, in the interests of aesthetics, public health, and even of the production of timber, that all these quarries, tips, excavations, etc., and any waste areas that spoil the landscape should be covered with vegetation.

Regarding Belgium, the Administration of Waters and Forests should be charged with carrying on the law of August 12, 1911, on the preservation of landscapes and the transformation of the areas mentioned above. As regards land of a certain area that belongs to the State, the communes, or to public bodies, they should be dealt with like any other waste land and afforested. As regards privately-owned land of a similar nature, it is advisable firstly to act by propaganda or advice, with the help of Government officials in the direction of the work, by means of grants in money or in kind (seeds and plants), or by means of purchase by the State or the communes when this is possible.

From the cultural point of view, no afforestation should be undertaken without a thorough examination of the soil and of local conditions so as to benefit nature's teaching ; in difficult cases, herbaceous or shrubby, plants should be planted in the first instance. For planting strictly speaking : (*a*) choice should be made of trees suited to the soil and district, and wide use should be made of the robinia, which has proved its worth ; (*b*) small plants not older than 2 or 6 years) should, as a rule, be used ; (*c*) trees should be cut down to the ground in 3 or 4 years ; (*d*) rabbits must be destroyed.

536 - **The Eco-dendrological Problem of the Production of Forest Seeds.** — BORGHESANI, G. (Federazione Pro Montibus, Comitato per lo studio scientifico per lo studio dei problemi forestali in Italia, Sezione eco-dendrologica), in *Rivista di Biologia*, Vol. I, Pt. 5-6, pp. 559-585, 1 fig., bibliography of 63 publications. Rome, 1919.

Critical review of the question of the origin of forest seeds from the scientific point of view.

The first researches on the question of forest seeds were carried out on *Pinus sylvestris* by PH. ANDRÉ DE VILMORIN, who introduced the Riga or Livonian pine into France in 1820 and compared it with plants grown from French, German, and Scotch seed. At first, the results were in favour of the Riga pine, but now, after about a century, this pine has not maintained in France the high forestal qualities that it shows in its original country.

VILMORIN'S experiments were not followed up and, in 1860, Dr. SCÜBELER, at the General Agricultural Congress at Gothemburg, announced his well-known laws, deduced from a series of botanical studies begun in 1848 and embracing most of the plants and their varieties grown in Europe. These laws, which stated the superiority of seeds from the North or from high altitudes, were supported by agronomists and experts such as TISSERAND and DE VILMORIN in France, WITTMARCK, NOBBE, WOLLNY in Germany, PETERMANN, in Belgium,

and ROSTRUP in Denmark, and brought these seeds into great fashion, from which Northern forest seeds profited as well, though SCHÜBELER had never dealt with them.

In 1887, the original and conscientious researches of CIESLAR, Director of the Forestry Station of Mariabrünn, on spruce, Scots fir, and larch, brought a true perspective to the enthusiasm of foresters for seed from the north or high elevations. In Switzerland, the necessity was also felt of carrying out similar experiments, on account of the extreme diversity of the forest soils in altitude, exposure, geological structure of the subsoil, etc., to which very different conditions of growth are due. For this reason, Prof. ENGLER, Director of the Zurich Experimental Station began researches in 1899 and published his results in 1905. They dealt with the fir, larch, and mountain maple, and fully confirmed CIESLAR'S results. On account of the importance of these researches, it is worth while to quote the principal conclusions.

After the researches of CIESLAR and ENGLER, the study of problems relating to the origin of forest seeds was taken up in those countries where the study of forestry is most closely followed (Austria, Belgium, Denmark, France, Germany, Japan, England, Russia, United States, Sweden, Hungary); special comments were made on it at the Eighth International Congress of Agriculture at Vienna in 1907 and in the different Congresses of the International Union of Experimental Forestry Stations; in this way, a plan of collective researches was drawn up by the Institutes that formed part of the Union, a plan that originated at the end of the third Congress at Vienna, in 1900, following up the subject put forward by Prof. MAYR OF Munich University, dealing with the effect of the origin of the parent plants on the seeds.

Most of the publications issued after 1905 dealt with the importance of the origin of *Pinus sylvestris*. Thus at the sixth Congress of the Union of Experimental Forestry Stations, held at Brussels in 1910, this subject was dealt with afresh and in detail and 4 reports were presented by N. S. CRAHY (Chief Inspector of Belgian Forests), Dr. ZEDERBAUER (Forestry Experiment Institute of Mariabrünn), Prof. MAYR and Prof. ENGLER. These reports gave preliminary data of experiments done or in view and suggested that forest managements should be provided with seeds adapted to the locality.

A number of measures were taken by the different States to protect forest owners against the purchase of unsuitable foreign seed. Sweden was the first to do this and, in spite of a heavy increase in the import duty applied in 1898 to seeds of Scots fir and spruce, established by the law of April 4, 1910, demanding that any imported seeds of species of *Pinus* and *Epicea* except *Pinus Cembra* and *P. sibirica*, should be stained with eosin. In 1911, in Germany, it was decided by the Forest Council to establish a union of owners of large drying machines, who undertook under the supervision of the Council itself, to use none but German cones, the idea being to eliminate the introduction of seeds from other countries, especially Hungarian and French seeds of inferior quality. It should be noted that, in Prussia, at any rate in the State forests, it is now possible to obtain suitable forest seeds, because each estate has had its own driers for some years.

In 1913, ENGLER published a 2nd series of studies, in which, using new experiments on *Pinus sylvestris* and spruce, as well as work by other authors as a basis, he showed that in certain forest trees (Scots fir, spruce, larch, maple, oak), morphological and physiological aptitudes acquired under the influence of the climate are transmitted to the progeny and finally become permanent.

In 1915 HAUCH described experiments on oaks of various origins for the Experimental Forestry Commission of Denmark, with the object of ascertaining the effect of the origin of the seed on the resulting plant.

In 1915, SHIRSAAWA published the results of researches carried out at the Forest Experiment Station at Meguro (Japan); these researches, made with Japanese seeds and continued for some 10 years after they were initiated in 1902, constitute the Japanese section of the general plan of the researches on the origin of forest seeds organised by the International Association of Experimental Forestry Stations.

SCHOTTE, in 1915, gave the latest results from researches carried out by the Swedish Experimental Forestry Institute on the origin of the seeds of the Scots fir, the third series of which dates from 1907-1908 when the Swedish section of the international series of experimental sowings with seeds of the Scots fir was worked in accordance with the above mentioned plan.

Summing up the results of these researches the author says that for the solution of the eco-dendrological problem of the production of forest seeds, the following information is now available:

(1) There are various types of the common forest trees, each of which has hereditary ecological, dendrological, and alsometric characters.

(2) For the moment, the most important of these types from a practical standpoint is that of climate.

(3) Without absolutely denying the practical value of forest selection (ENGLER), the chief question for sylvicultural technique is to recognise the value of the various climatic types for any given station.

(4) In consequence, the origin of forest seeds is of the greatest importance to the success of plantations of the chief forest trees.

(5) The failure of many plantations is due to the unsuitable origin of the seeds or plants.

(6) The provision of supplies of forest seeds gathered in the various regions is required, and such seeds should be used in their natural stations.

All this refers to the common forest trees and not to the acclimatisation of exotic trees, for which a vast field of experiment is open. In any case, even with exotic trees the origin of the seed ought to be ascertained taking care that the conditions of the natural habitat correspond to those of the new country, and while trying to obtain suitable supplies of trees already introduced which have given good results.

537 – **Action of Climate, especially Temperature, on the Formation and Germinating Capacity of Seeds of *Pinus sylvestris*.** — WIBECK, E., in *Meddelanden från Statens Skogsförsöksanstalt*, Part 17, Nos. 1-2, pp. 1-20, frgs 6 Stockholm, 1920.

Results of a series of investigations concerning the action of climate, especially temperature, on the formation and growth of the seeds of *Pinus sylvestris* in Sweden.

The author considers that the forms of pine due to the climate a subject which has recently been much examined from the systematic point of view, are indirectly related to the climate in October and November. In this work, however, and in the division of the country into thermic zone, the average annual temperature has been taken into account. There are successive, constant zones characterised by an average annual temperature less than —1° C in the first zone; included between +1° and —1° C in the second; between +3° and +1° C in the third; between +5° C and +3° C in the fourth zone; and so on.

The material studied was divided according to its germinating capacity into three groups. The first group includes germinating percentages from 0 to 40 %, the second from 41 to 50 %, and the third those above 50 %. In the appended map, Fig.1, the third group is shown by a black dot, the second by a cross-hatched circle, and the third by a white circle.

HAGEM, whilst conducting similar investigation in Norway, observed the effect of summer temperatures on the production of seeds capable of germination for this purpose June-August temperatures must not be lower than

Fig. 1. — Production of pine seeds capable of germinating as regards the isotherms of the period June-August.

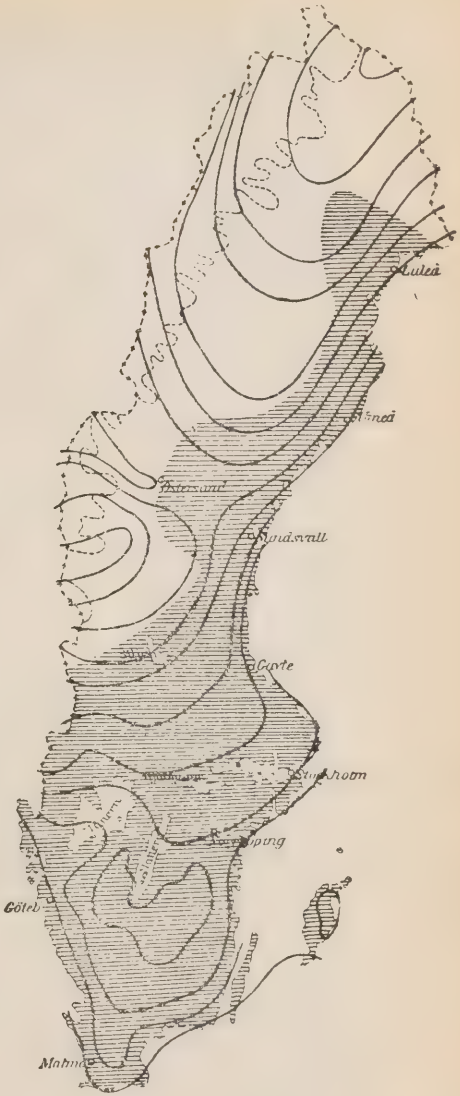


Fig. 2. — Division of Sweden into 2 regions with germination capacity respectively superior (hatched) and inferior (white) to 50 %. The curves represent the November isotherms.

+10.5° C. Similarly, the author examines the dominant effect of the June-August temperatures in Sweden The isotherm +13° C for 1916 and the isotherm +14° C for 1917 divided the country into two clear sections, one

eastern, one western. In the eastern section the percentage of seeds capab of germinating is above 60 %, while, in the western section, howeve it is below 30 %. The conclusion is, then, that to obtain a crop of see with a germinating capacity over 50 %, the minimum average temperatu during June-August must be +13° C. In Fig. 2, the horizont hatchings indicate those parts of Sweden where the average June-Augu temperature is over 13° C. These regions coincide (*cf.* Fig. 1) with tho regions where the germination is equal, or superior, to 50 %. Besid their scientific interest, these results are of considerable practical val as regards the choice of seed for study in relation to the formation of nu series, for it will be advisable, in every case to examine the coastal regio (eastern sector). The author points out the need for meteorological o servations in forests, especially during the period from June to Augus

Recent anatomical investigations appear to show that the delay germination and the poor germinating power are related to the develo ment and formation of the embryo. Material was examined from t Garpenberg reserves (Dalécarlie), a southern zone with favourable climat and from the Sikå reserves (Norbotten), a north-west zone with unfavou able climate. In seeds from the latter region, great variability w noted in the length of the embryo, usually slightly developed (length embryo in proportion to the total length of the endosperm = 19 to 89 % with an average of 61.36 %.) On the contrary, in the former locality, whi was more favourable as regards climate, the embryo, while longer on t average, was also less variable (43-92 %, with an average of 76 %.)

Owing to its growth being slow and with little intensity, the embry on account of its feeble vitality, is doomed to a slow intraseminal growt which, only after a considerable period, enables it to react to external fa tors and germinate by passing through the spermoderm.

538 – **Experiments on the Lopping of Resinous Trees.** — Note du Service spécial d expériences et constatations scientifiques forestières, in *Bulletin de la Société Centr forestière de Belgique*, Year XXVII, Vol. 3, pp. 131-140. Brussels, March 1920.

As a rule foresters are not in favour of lopping green branches in c niferous plantations, but, all the same, at times, a certain number of bra ches have to be cut. This occurs in plantations established gradually, that some trees are more advanced than others, or isolated trees, avenues, or when a first clearing has to be made. In these cases, so say that they must be lopped up to the trunk, while others affirm th a stump, which will fall on its own accord naturally, later, must be left. account of these divergent opinions, the Belgian Research Service h attempted to solve these two important questions experimentally.

Young spruce which formed a shelter belt to the Arboretum, at Gr nendael were lopped, every 15 days, starting on September 15, 1912, alwa by the same workmann. Five trees were successively sawn off cl to the trunk, the little knot of resin at the base of the branches being le the man sawed the branches of the next two trees at about 10 cm. fr the trunk. A year after, the stump was sawn close to the trunk. Th

rees were lopped with a bill-hook as an experiment. In this way, 10 rees lopped every fortnight by the same man. As a flow of resin is considered to be a sign that a tree is weakening, observations, which were begun on May 27, 1915, were nade on that basis.

The experiment showed that the best results were obtained by opping so as to leave a stump, which was sawn off a year after. It should, nowever, be observed that the wounds were not completely callused and hat the time required to complete callus formation is of prime importance n forming an opinion as to the value of the method. Complete healing-over requires at least 3 or 4 years. Lopping flush with the trunk, using a saw, also gave excellent results, and this method is apparently more advisable because it costs less than the previous method, and, in addition, a saw is easy to handle. Lopping with as bill-hook is the least advisable procedure, as it always caused a considerable flow of resin, in spite of the ability of the workman, and it is very difficult, requiring as it does a smart and careful workman.

Coniferous trees should be lopped at the height of the summer heat. for then there is the least flow of resin. But the results were not entirely conclusive as regards this, and the observations should be continued until the wounds are completely healed and definite conclusions can then be drawn.

539 - **The Para Chestnut, or Brazil Nut.** — *Bulletin commercial de la Section des Affaires économiques et commerciales du Ministère des Relations extérieures de la République des Etats-Unis du Brésil*, No. 9, pp. 29-30. Rio de Janeiro, 1919.

The Para chestnut (*Bertholetia excelsa*) is one of the finest trees of the vast forests of the Amazon. It grows slowly and only produces fruit, at 12 years old, when the tree, whose rigid, cylindrical trunk is admirably suited to constructional work, attains a height of 35 to 40 metres. M. J. Huba, formerly Director of the Botanical Museum of Para, has furnished the following information regarding this and other chestnuts of Para :

One of the great resources of the Amazon region is the immense chestnut forests, of which only a small part has been exploited as yet.

The delicious Brazil nut or " Para nut, " of which some 50.000 hectolitres are exported annually to Europe and North America, is the seed of the enormous *Bertholetia excelsa*, which mostly grows in large groups in the forests whick cover the plateaux on both banks of the Amazon and its tributaries.

The large, husked, round fruits ripen during the rainy season (January to March), and fall intact, covering the soil in hundreds, when they are gathered, heaped up and opened with an axe.

The fresh nuts contain much milk, of which the natives make broths, cakes and condiments. When dried, they become oily. Each husk contains from 15 to 20 Brazil nuts. The husks make exellent fuel and can be used for decorations in cabinet work.

Another fairly important products of this tree is the tow that is extracted from the bark.

Chestnut forests occur in large numbers in the Tocantins region, in the Curua and Para valleys, in all the regions watered by the river Tronbetas and its tributaries the Cumina, Cuninamirim, Erepecu, and especially on Airamba, in the plain as well as in the extensive plateaux.

The nut, for which there is an ever-increasing demand, as the consumption is spreading everywhere, is a product of which Para possesses very vast areas, as yet uninhabited, but already traversed by several explorers.

Immense regions covered with forests of chestnut trees and rubber are being continually discovered.

The nut takes second place among the exports from the Amazon. Since the war, the exports have decreased, thus interrupting the progressive increase that had previously been shown. The exports of Brasil nuts from 1913 to 1918, inclusive, were as follows:

Year	Metric tons	Paper milreis
1913	4 113	2 464 000
1914	19 117	7 729 000
1915	7 611	3 920 000
1916	9 882	7 175 000
1918	6 450	3 700 000

The nuts are much used in England and the United States, where they are known as Para nuts or Brazil nuts, in confectionery. They can also be used industrially for the preparation of an oil suitable for lubricating delicate machinery.

540 – **The Study of the Physical and Mechanical Properties of Wood in France.** — *Les Bois*, Year XXXIX, No. 4, p. 1. Paris, Feb. 15, 1920.

The French "Administration des Eaux et Forêts" has combined with the technical section of Military Aeronautics in the study of the physical and mechanical properties of wood and, by a circular dated January 8, addressed to the Conservators of Waters and Forests, M. DABAT, director general fo the "Eaux et Forêts" has laid down the methods to be followed in this work; the chief details are given below.

A choice will be made, in the forest estates where the tree occurs under normal conditions of growth, of 3 samples of the wood of each of the trees, the samples to be obtained by the forest officers. The samples will be taken either from trees specially exploited on behalf of the Government, from trees exploited for the Navy, or from certain trees marked out for sale, the provision of these samples to be accurately charged to the cutting.

The tree must be accurately named, and there must be no ambiguty as to its botanical identity. As regards the choice and dispatch of the sample, the following instructions must be followed:

Choice of a typical tree: The sample must be taken from an average tree, typical of the stand, of average girth, with a straight stem, not flat-

tened, without twisted fibre, free from apparent defects, and quite healthy.

Choice of a sample : The sample will consist of a block 1 metre long, cut at from 6 to 10 metres above the ground, and from a part that is not flattened, knotted, or defective.

Marking the sample : On each transverse section, a progressive number, the name of the forest and the number of the Conservation will be marked idelibly (burnt in or painted).

Index card : For each sample a card will be filled up giving the two details above, the name of the tree, and the geological nature of the soil, the method of treatment and any commercial uses of the wood (timber, joinery, etc.).

LIVE STOCK AND BREEDING

541 - **Goring as a Defect of Cattle.** — BIANCHI, G. (R. Scuola Superiore di Veterinaria, Torino), in *Il Coltivatore*, Year 66, No. 9, pp. 243-245. Casale Monferrato, March 30, 1920. HYGIENE

Goring in cattle is a vice and can be a subject of legal action, though in this case the defect must really belong to the character, i.e., to a serious defect of the central nervous system, and then nothing can be done but to send the animal to be slaughtered. But the author has concluded from his wide experience that this defect is transitory and limited. Without there being a defect in the character, cattle may gore : (1) On account of their youth and because they are not yet broken in ; (2) because the animal has been moved to another shippon (a change in environment has a temporary influence on the character of an animal belonging to any species) ; (3) because of a sudden change of the cow-man ; (4) owing to ill-treatment, even of a passing nature, to disease, or to the administration of a therapeutic or prophylactic diet. Goring is particularly caused by : otitis ; by the presence of foreign matter, parasites, etc., in the auditory canal, on the ala, etc.; by subcutaneous injections in the sides of the neck, etc. To ascertain a temporary or permanent liability to goring, the animal must be watched on several occasions, and the different parts of the head and its organs must be examined.

542 - **Piroplasmosis of Cattle in France.** — PANISSET, L., (Professeur, a l'Ecole vétérinaire de Lyon), in *La Vie agricole et rurale*, Year IX, No. 46, p. 366. Paris, Nov. 15, 1919.

Little is known as to the geographical distribution of piroplasmosis in France and, as yet, the disease is not of great economic importance. It has been reported mainly from Normandy and from the Maubeuge district. A remedy recommended by the author is the intravenous injection of trypanoblue, which has given excellent results in France ; as prevention, the destruction of the ticks by arsenical dips is advised. As there are only a few centres of the disease in France, curative treatment is all that is needed at present.

543 - **Prophylaxis against Bacterial Anthrax by Means of Vaccination, in Morocco.** — MONOD, T. H. and VELU, H., in the *Bulletin de la Société de Pathologie exotique*, Vol. XIII, No. 1, pp. 14-16. Paris, January 14, 1920.

CHAUVEAU'S work has shown that Algerian sheep are resistant to bacterial anthrax of French origin. As Moroccan sheep belong to the same breeds as those of Algiers, it was logical to presume that they too were naturally resistant to the disease originating in France and, *a fortiori*, to the second "pastorian" vaccine. For this reason, vaccination could be carried out by injecting the second "pastorian" vaccine, and an experiment carried out in 1919 on these lines was completely successful. The same method gave equally satisfactory results when applied to the native swine and cattle in Marocco.

Immunity obtained in Morocco with pastorian vaccines does not always last a year, but only 8 or 10 months, possibly less. The duration of immunity should, therefore, be prolonged and maintained either by renewing vaccination at least twice a year, by giving a second injection of the second vaccine in double the dose, or by the subsequent injection of a very slightly attenuated culture.

544 - **The Control of External Parasites of Poultry** (1). — *La Vie agricole et rurale* Vol. XV, No. 47, p. 383, figs. 2. Paris, Nov. 22, 1919.

The destruction of ticks on poultry is, if not difficult, at least a lengthy process. They have to be dealt with one by one, either by pulling them away, which always caused a nasty little wound, by touching them with a brush soaked in paraffin, or by cutting them in two near to the head as possible, using curved scissors.

Of the many methods used to free poultry from harmful vermin, only two are both efficacious and capable of being used by anyone. These methods consist in soaking the feathers with paraffin and using a bath of potassium pentasulphide.

All the so-called insecticidal powders are only effective when freshly prepared, which is rarely the case. They are also defective in that they do not adhere either to feathers or skin, so that the birds get rid of them almost at once. A certain adherence can, however, be obtained if the plumage is wetted with soapy water before applying the powder.

Painting the inner face of the feathers with a small brush soaked with paraffin gives excellent results. Care should be taken not to touch the skin with the paraffin, as it causes a slight irritation.

In more serious cases, in which the poultry are covered with mites, lice and ticks, a more radical treatment is required, which is quite harmless. Potassium pentasulphide is dissolved in boiling water at the rate of 30 gm per litre of water. When the solution has cooled to 30° C, the bird is entirely immersed, except the head, for 1 minute. The solution should not touch the eyes; therefore, the head feathers should be wetted with the finger or a brush. Afterwards, the feathers are drained by pressing them lightly

(1) See *R.*, Sept. 1917, No. 830 and *R.*, April, 1919, No. 495. (*Ed.*)

then the bird is placed on thick litter sheltered from cold, draughts, and sunshine.

Parasites sometimes cause eye troubles, and in this case the eyes are treated with 3 % copper sulphate solution, or by washing the eyes with tepid boricated water, and drops twice a day of silver nitrate solution made up of 0.25 gm., silver nitrate to 100 gm. of distilled water.

545 – **Maintenance and Reproduction with a Diet of Grains and Grain Products.** — HART, E. B. and STEENBOCK, H., in *The Journal of Biological Chemistry*, Vol. XXXIX, No. 2, pp. 209-233, 13 charts. Baltimore, MD. Sept., 1919. ANATOMY AND PHYSIOLOGY

Rats and pigs were used in maintenance experiments on adult animals fed solely with cereal grains (wheat, maize, barley) or their products. For experiments on reproduction, swine were used which had grown up on any normal ration and which were subsequently fed with : (1) Maize alone, barley alone, or oats alone ; (2) a mixture of maize and oats ; (3) maize gluten feed ; (4) maize + oats + middlings + oil meal ; (5) barley + 2.5 % of wheat gluten ; (6) oats + oil meal. All the rations were given with drinking water, and all save the fourth were given with a little common salt at the rate of 1 per cent.

The results, given in charts show that adult animals can be maintained with grains and their products, plus water and salt, for a considerable time, but complete nutrition with these rations is impossible and after a time a decline inevitably sets in.

When such rations are given to sows, they cause the young to die at a rate that increases with the time. The first litter may be fairly successful, but in succeeding litters more and more young are still-born. This bad nutrition is primarily due to inadequate supplies of mineral matter and ultimately to the lack of coarse food and to an inadequate mixture of vitamines. In fact, pigs were successfully reared on a ration consisting of oil meal gluten feed and a suitable mixture of salts. With grains such as oats and barley, the lack of fat-soluble vitamines may be of greater importance than in the case of yellow maize meal.

The birth of dead pigs owing to inadequate nutrition has been previously reported by the authors (HART, E. B., MCCOLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., *Research Bulletin* 17, *Wisconsin Experiment Station* 1911 ; *Journal of Agricultural Research*, Vol. X, p. 175, 1917 ; Bull. 187 *Wisconsin Experiment Station*, 1918) for herbivorous animals. A ration of grain, poor roughage, such as cereal straw caused either abortion or the birth of calves before their time or dead. This was mainly due to the lack of mineral matter, especially calcium, since it could be eliminated as with sows, by the addition of calcium salts and common salt.

The function of calcium as a constituent of bone and milk is well known, but, in addition, as CLOWES has shown (*Journal of Physiological Chemistry*, Vol. XX, p. 407, 1916), the constitution of the protoplasm of the intestinal cell-walls is modified by the equilibrium between the salts of sodium and calcium. A diet with insufficient calcium would lead to con-

ditions of the intestinal wall that are specially favourable to the continuous absorption of products of intestinal origin, amongst which there may be bacterial toxins or amines. This finally leads to physiological disturbances, to an abnormal stimulation of the central nervous system, which causes the limbs to tremble and to vasoconstriction and to interference with the normal oxidative processes in the tissues, thus leading to intoxication and asphyxiation.

FEEDS AND FEEDING

546 – **The Use of Woody Matter as Cattle Food.** — SCURTI, F. and DROGOUL, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Parts 10-12, pp. 490-496. Modena, 1919.

SCURTI and MORBELLI have previously shown (1) that the woody matter in maize stalks separates when submitted to acid hydrolysis under pressure, forming cellulose and sugars, thus changing an almost entirely indigestible fibre into a group of compounds that are valuable as cattle food. The authors have continued this work and, in this article, they have examined wheat straw to see if it can be changed into similar compounds, and if so, to what extent.

Finely ground straw has the following percentage composition: Fats (ether extract), 2.53; crude protein (N × 6.25), 3.64; fibre, 33.76; ash, 4.90; nitrogen-free extract, 55.17; pentosans, 27.30. The straw was heated to 130° C for 2 hours with: (1) Caustic soda in the proportions 1 part straw, 10 of water, and 0.0125 to 0.10 parts of caustic soda; (2) 25 % sulphuric acid solution in the proportion 1 of straw, 10 of water, 0.0125 to 0.25 parts of sulphuric acid; (3) hydrochloric acid in the proportions 1 of straw, 10 of water, 0.020 to 0.125 parts of hydrochloric acid gas; (4) 25 % nitric acid solution in the proportions 1 of straw, 10 of water, 0.025 to 0.15 parts of gaseous nitric acid.

Treatment with caustic soda only partly separates the lignified cellulose, and the final product still contains considerable quantities of pentosans and traces of sugars. Treatment with sulphuric acid liberates up to 66.16 % of cellulose and up to 32.59 % of sugars. Hydrochloric acid is still more active than sulphuric acid, and frees up to 71.30 % of the cellulose and up to 33.02 % of the sugars. Nitric acid yields up to 66.34 % of cellulose and 34.79 % of sugars, and is, as regards the sugar, the most powerful reagent of all.

As cellulose, when isolated from encrusting material and hemicelluloses, does not differ from starch as regards assimilability, wheat straw is an excellent raw material for the preparation of cakes of cellulose paste and sugars.

547 – **The Utilisation of Hevea Seeds as Cattle Food** (2). — FREIRE, D. (Brazilian Consul-General, Liverpool), in *Bulletin commercial de la Section des Affaires économiques du Ministère des Relations extérieures de la République des Etats-Unis du Brésil*, No. 8, p. 48. Rio de Janeiro, 1919.

The shortage of cattle food now being felt in England has led to the examination of other possible foods and, in this respect, experiments have

(1) Summarised in *R.*, July-Sept., 1919, No. 936. (*Ed.*) — (2) As regards the utilisation of rubber seeds for the production of oil and as a cattle food, see *R.*, Dec. 1913, No. 1362; *R.*, March 1914, No. 240; *R.*, Sept., 1918, No. 987; *R.*, July-Sept., 1919, No. 993. (*Ed.*)

shown the superiority of rubber-seed cake. So far, however, no commercial use has been made of the enormous quantities of seeds from the plantations in Malacca, Ceylon, Java, Sumatra, Southern Indies, and Brazil.

Two experiments were made ; in one the cake was given soaked in water to cattle, and in the other, dry. With the exception of 3 animals which showed aversion to the food, the other animals took it greedily. As the cake is naturally dry, on soaking it absorbs its own weight of water and is then more easily ingested by the animal. After being fed for 3 days exclusively on rubber-seed cake, the cattle thus tested showed no signs of disturbance and no effect whatever was observed on the milk.

If Para rubber-seed cake were put on the market in quantity, its rivals made of linseed, husks and residues of kernels, would disappear from the market as they could not face the competition. In fact, rubber-seed cake is practically identical to linseed cake, while Euphorbiaceous seeds such as those of rubber are easier to obtain and manipulate.

Experiments with sheep, however, did not yield the good results obtained with cattle.

It can thus be said that rubber-seed cake constitutes an excellent food for fattening cattle.

It, is hoped in England that the planters in the Far East will co-operate with manufactures in order to organise the production of this cake If this were done, the British colonies would greatly benefit, as a commercial use would have been found for a product previously considered as totally unutilisable, and the same thing would happen in the Amazon valley, which could export large quantities of rubber seed.

548 – **Toxicity of Cacao Shells to Horses.** — Fonzes Diacon (Director of the Laboratory of the 16th. Command), in *Annales des Falsifications et des Fraudes*, Year XIII, Nos. 135-136, pp. 34-35. Paris, January-February, 1920.

Following on the observations of MM. Marchandier and Goujon on the toxicity of cacao shells and on the poisoning of horses observed by them (1), the author brings forward confirmatory evidence based on personal observations dating back to the end of 1918. In fact in October, 1918, at the Engineer's Barracks at Montpellier, horses showed violent excitation following on a daily injection of a mash made of cacao shells, requisitioned from a local chocolate maker (2), and some animals died.

(1) See *R.*, Feb., 1920, No. 217. (*Ed.*)

(2) "Cacao shells are the residue from chocolate making. Zipperer found that the shells constitute 12-18 % of the raw beans, or an average of 15 %. As the addition of the shells to chocolate or cocao is considered to be adulteration, even in the case of cheap grades, the shells cannot be used in this way. So far they have been sold under the name of "cocoa tea", and an attempt has been made to improve their taste by "icing" them. These candied shells are much in favour in eastern Germany ; they have been used also as pharmaceutical specialities and 5 % of cocoa butter can be extracted from them, as well as theobromine. They have been made into cattle cake, selling, according to Zipperer, at 7,50 to 9 fr. a quintal, and of a feeding value between that of good hay and wheat bran" (Chevalier A., *Les Végétaux utiles de l'Afrique tropicale française — Le cacaoyer dans l'Ouest Africain*. Published by Challamel, 17, Rue Jacob, Paris, p. 20). According to the experiments now in question, cacao shells are dangerous to horses, and it would be of interest to ascertain their effect on other domestic animals. (*Ed.*).

The author, called in by the veterinary surgeon at the barracks, suspected the cacao shells, and stopped them being fed. In fact, a mash of cacao shells contains about 700 gm. of shells with 0.7 % of theobromine so that each day some 5 gm. of the alkaloid were being ingested, and horses were very sensitive to it.

STOCK BREEDING

549 – **A Possible Market for Normandy Livestock in the Export of Breeding Animals.** —LIGNIÈRES, J. (Communicated by M. P. Dechambre, remarks by M. Viger), in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VI, No. 2, pp. 42-48. Paris, January 14, 1920.

M. DECHAMBRE communicates the text of a lecture delivered before the "Société centrale d'Agriculture de la Seine Inférieure" (France) by Prof. J. LIGNIÈRES, of Buenos-Ayres, on the introduction of French livestock, particularly that from Normandy, into South America, and outlines the programme to be followed for developing the export of Norman breeding animals to South America.

As regards both meat and milk production, there are good reasons why French livestock should find a market in South America. As regards meat, if the South American breeders wish to sell cold-storage meat to French clients, they should cater for their taste, so that meat from French breeds would be quite satisfactory. This would ensure success, for the interests of both parties would be safeguarded; the foreign breeders would profit from the sale of meat in France and the French breeders would profit from the sale of breeding animals.

In his lecture, M. LIGNIÈRES dealt more particularly with Norman cattle as milking animals.

In the Argentine, the dairy industry has developed greatly and is expanding more every year. It would thus appear that the Norman breed is pre-eminently suited to help the Argentine dairy industry to develop still more. But if sufficient exportation to South America is to be maintained, certain rules will have to be strictly observed.

Breeding in Argentina has attained such a degree of development that only the best is required, and French breeders should, therefore, take care not to send any mediocre animals that would reflect on the quality of their livestock as a whole. The pedigree of the animals is of prime importance. A well-kept herd book, in which names are admitted only after the closest investigation, is a basis for asking high prices and for gaining the confidence of the foreign buyer. This point is very important, and is a complementary argument to those already enunciated for the proper and extensive organisation of French herd books. To perpetuate and increase the value of the Norman breed as regards milk and butter production, the control associations which carry out scientific selection of the animals should be extended.

Success in exporting also depends on another important point, i. e. the commercial organisation, and it is indispensable that the breeders should form syndicates to direct and control exportation.

But a consideration still remains which, if not perfectly satisfied

suffices in itself to cancel all other efforts, and that is the sanitary question. M. LIGNIERES states that this was the chief cause that lost the Argentine market to Norman cattle and this shows its importance.

In any case, exportation to South America could be establishment on a wide basis and be of great service to French breeders. The objection that French breeders cannot export, so as not to hold back the progress of the reconstitution of French livestock, is a grave error. Trade is the best index of production and exportation can be said to be sign of the quality of a product.

The broad lines of the proposed programme include the more extensive use for herd books, control of the yield, the adaptation of the product to the needs of the importing country, the foundation of syndicates and commercial organisations, and the adoption of sanitary measures that will give the necessary guarantees.

At the conclusion of the communication, M. VIGER pointed on the success attained a few years ago at an international exhibition of agriculture in the Argentine by a fine lot of animals belonging to the Charolais breed, sent by General DE LA GUICHE, a well-known rearer of that breed in France. All the animals were bought and were much appreciated.

550 – **Stock-breeding in Calabria.** — BARTOLUCCI, A., in *L'Italia agricola*, Year 1, No 12, pp. 364-370, 3 fig. Piacenza, December 15, 1919.

At the time of the census on April 6 and 7, 1918, there were in Calabria 10 469 horses, 79 164 asses, 7 958 mules and hinnies, 139 865 cattle, 69 buffaloes, 138 587 pigs, 692 047 sheep, and 441 852 goats.

Compared with the 1908 census there was an increase in the sheep of 46 719 head, in the goats of 80 838 head, a smaller iucrease in the asses of 10 892 and in the pigs of 6 629 head. On the contrary, the other species showed a decrease, especially in the cattle (5 453 head less). The decrease of cattle and increase of sheep and goats furnish a sign of agricultural decline, but this is partly due to temporary factory factors brought about by the war.

Calabrian *cattle* are derived from the Podolian stock and, when not selected, show the defects of that breed, viz., great development of the fore-quarters, poor development of the hind quarters, drooping rump, slight thighs. As compensation, however, they are of good appearance and have good hoofs; they are hardy, vigorous and make good use of their food. In the cereal zone, they are reared on pasture, which is changed every now and then ; on wooded estates in the hill and citrus zones, they are reared under cover, though this is usually scanty.

In the bergamot-orange plantations in the province of Reggio, one or two oxens are reared under cover and during autumn and winter they are fed on the pulp left as a by-product on the extraction of lemons and bergamots. They are often used to drive the numerous machines for lifting water.

Around Paola, excellent beef calves are reared and these, like those of the province of Reggio, are usually crosses between the Simmenthal

and Reggiano breeds. With systematic selection, excellent triple-purpose cattle could be reared, as some cows are heavy milkers, while the oxen are good workers and yield good meat. The average milk production is 12 hectolitres of milk per head per year, and 100 cows produce 60 to 70 calves each year. Crossing with the Gentile Romagnola breed is done only in those places where there is sufficient shelter and food to meet the greater requirements of the crosses obtained. Cattle rearing could be much developed, rather than improved.

The Calabrian breeds of *sheep* originated from the Merino and it is stated that the "mileto-tarentino" sheep is the original stock of the Spanish merino. There are two breeds of Calabrian sheep, the native and the "gentile," of which the former is small, hardy, with a bristling, black and white fleece, a poor milker and a scanty wool producer, whereas the latter derived from the first breed by repeated Merino crosses, is larger and yields finer and more abundant wool.

There are two breeds of goats: native ("nostrana") and Maltese. The former are small, poor milkers, very quiet, and the latter have no horns, have a finer fleece and are better milkers. The he-goats live with the she-goats in the proportion of $\frac{1}{4}$ to $\frac{1}{10}$ of the latter. Sheep and goat rearing is entirely nomadic; it is of great importance in olive plantations.

The pigs, of Celtic origin, constitute two varieties, the "macchiaiuola" (spotted), the more hardy of the two, and which feeds in oak or chestnut woods and in fields where there are plenty of fresh, fleshy roots, and the "casalinga" (domestic), reared on farms and in villages. Crosses with Yorkshire pigs are common in the provinces of Cosenza, Catanzaro and Reggio Calabria.

Horse rearing is falling off more in quality than in point of numbers. Formerly, Calabrian horses were famous as products of Arab and Andalusian horses, but now they represent a great mixture of breeds. In Calabria, the chief direction which horse breeding should take is the production of sadde horses of the oriental type.

The importance of mule and ass breeding in Calabria is due to the great lack of carriage roads. The mules are excellent for military purposes.

The chief product yielded by the cattle and sheep is milk. The cheese industry turns out, even using old methods, famous products such as the following: Marchesato (Cotrone) cheese; "caciocavallo" cheese (1), with fermented curd, which is worked in hot water; "butirro" cheese (2) (made either with pure sheeps' milk, goats' milk, or a mixture of the two), with slightly cooked curd; and "ricotta" (3).

In the littoral zone of large estates and on the plateaux, the large

(1) "Caciocavallo" is a cheese with ropy curd, shaped like a calabash, which are tied in pairs, which are slung "a cavallo" (whence the name) or straddling over a rod to mature. — Cf. Prof. C. BESANA, art. *Caseificio*, in *Nuova Enciclopedia Agraria*, Turin, 1908. (*Ed.*)

(2) The "butirro" (= butter) cheese is a shell of cheese filled with butter. (*Ed.*)

(3) "Ricotta" is made by coagulating the albumen in the whey or "serai", then applying slight pressure. (*Ed.*)

livestock establishments have the following numbers of stock: Sheep, 800-1000 head (up to 2000-3000 head in the Cotronese); cattle, 120-150 head; pigs 40-50 sows with 10 boars. The medium-size farms, which are the commonest, have 30-50 cattle, 200-300 sheep, and 15-20 pigs. The small farms have from ½ to ⅓ the number of stock of the medium-size farms, and some have herds of 15-30 goats each for the supply of town milk. Most of the large and medium-sized farms are managed, from the economic point of view, by larger owners or industrialists from the Ionian littoral, with a permanent staff. The small farms are run either on the renting system or the tenant system.

The livestock, reared on the system of changing pasture, spends the winter on the coastal plains and the winter in the Sila on an area of 100.000 hectares, at an altitude of 1900 metres. Formerly, that zone was entirely wooded, but now, especially in the central part, it has mostly been cleared for growing cereals (usually rye), alternating with meadows and potatoes; flax is also grown there. In the summer, over 20 000 cattle are pastured there (only the draught oxen are left on the "marine" or shore pastures), as well as 100 000 sheep, about 5000 horses and a large number of pigs.

551 – **Stock Rearing in French West Africa** (1). — I. Report by M. G. Moussu on a paper by M. J. Derré, "entitled" La production des animaux domestiques en Côte d'Ivoire", in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 8, pp. 220-222. Paris, February 22, 1910. — Report by M. Dechambre, on two papers by M. Alsigé on the "Situation de l'élevage et disponibilités en viande de l'Afrique Occidentale française" and "La peste bovine dans l'Afrique Occidental Française, 1915-1918", *Ibid.*, pp. 222-224.

As regards livestock, the Ivory Coast colony can be divided into three zones:

(1) A lower, woodland zone, stretching from the 5th to the 7th degree of north latitude, where there are only small herds which have the valuable quality of resistance to the attacks of *Glossina* spp., the carriers of parasitic blood diseases (trypanosomiases). There are only 5000 cattle, 18 000 goats, about 14 000 sheep, on an area of 120 000 sq. km., according to the 1918 census. The cattle are of the lagoons breed, and the sheep of the Fouta-Djallon breed.

(2) A central or savannah zone, occupied by the Baoulé race. It appears that this zone was once prosperous and covered by abundant flocks which, unfortunately, have been decimated by the serious diseases that have affected African livestock for so long. The cattle have a weight of about 200 kg., with an average yield of 50 %, and are always in good condition, because the pastures never dry up und water is never lacking.

(3) A northern or Sudanese zone, which comprises the best breeds of the Ivory Coast, but which is more exposed than the others to the diffu-

(1) As regards livestock in French West Africa, see *R.*, July, 1914, Nos. 449 and 652; *R.*, Feb. 1919, No. 146; *R.* March, 1919, No. 273, For Sudanese wool-bearing sheep and their wool see *R.*, March 1919, No. 376, and *R.*, May, 1919, No. 624. (*Ed.*)

sion of epidemic diseases from the Sudan. There are 30 000-35 000 head ; the sheep and goats, which are very numerous, are derived from the Fouta-Djallon breed.

Horses are rare and very subject to trypanosomiases.

Two great diseases decimate the bigger livestock, i. e., pleuropneumonia and cattle plague. M. Moussu describes the history of these diseases and shows the extent of the damage they have done, He thinks that great impetus would be given to stock rearing if protective measures and a good sanitary service were put into action against the two above-mentioned diseases and against the various trypanosomiases. Detailed information is given regarding the situation in each district and on the methods for obtaining a general improvement by the selection of breeding animals and the foundation of farm schools, particularly required to teach the diets suitable for each period of the year. Food resources are not wanting, as products such as rice, maize, manioc, yams, etc. — all products that can be made use of in one form or another — are available. Any expenditure thus incurred would not only be easily recovered, but would represent a source of wealth for the future.

II. — During the terrible epidemic of cattle plague that affected French West Africa from 1915 to 1918, M. Aldigé obtained valuable information as to the progress of the disease and suitable sanitary measures for its control. The disease first started in the Niger and upper Niger regions, then spead to Upper Dahomey, Upper Senegal, and Niger, and then to the coastal colonies, Senegal, Mauritania, French Guinea, Ivory Coast, Dahomey, and Togo. It was carried from 1915 to 1918 usually on the caravan routes, by trading cattle going a long distance. The death rate was influenced by various factors (breeds, regions), but it was always high with young animals fed by the mother, and these mostly died. The mortality varied from 10 to 60 % of the adults, according to the breeds and regions ; the humpless small n'dama breed suffered most, while the Moorish zebu was the most resistant.

Sanitary action was supplemented by the use of serum, although great difficulties were met with in preparing large quantities owing to the lack of the necessary materials and trained men. All the same, the results obtained are in favour of active measures against cattle plague. Methods of defence consist in isolation and the creation of immune zones by the use of bile, immunising blood or serum.

The gravity of the epidemic that raged from 1915 to 1918 has shown that French West Africa, should protect itself as completely as possible against all contagious diseases, which, in fact, while severely affecting the number of colonial livestock, considerably reduce the number available for the home country. An epizooty such as that which has just deprived French West Africa of at least 2 million head of cattle should never be seen again. In addition, account should be taken of an important factor which is the very considerable diminution of the young animals which leads to decreased stock-rearing and to the prolongation over several years of the period during which a small number of cattle is available.

In spite of the losses during 1915 to 1918, cattle rearing remains of prime importance to French West Africa. The reorganisation of the Service of Animal Husbandry and Epizooties will give certain assurance for the security of stock rearing and marketing. The growing production leaves 500 000 animals suitable for killing each year, and as the local consumption is not more than 250 000 head, an equal number will be available for exportation.

552 – **The Lippizza Breed of Horses from Istria.** — *Giornale d'Ippologia*, Year XXXII, No. 6, p. 2; No. 16, p. 3. Pisa, March 31, August 21, 1919. HORSES

The famous breed of Lippizza horses belonged to the former Austrian crown. It derives its name from the estate on which it was bred, and which is situated 13 km. to the NW of Trieste, on the Carso plateau, at an average elevation of some 400 metres. The land is hilly, of purely carsic nature ; one part is under pasture, and the rest grows various trees. The climate is generally mild, the winter temperature varying between 8 to 22° C, while that of summer is never above 38° C in the shade and is always tempered by the sea breeze. In winter, the icy and violent "bora" wind often blows, but it causes no serious harm to the animals, which suffer more from the humid sirocco.

The Lippizza breed was founded in 1480 by Duke Charles of Styria, who imported 27 mares and 6 fine stallions from Spain. Later, some Italian mares of the "Marinette" breed, a breed of the Polesina which has now vanished, were imported. The modern Lippizza horse is the product of these two breeds, although the blood has been renewed several times by the introduction of Andalusian and oriental pure-breds. The last few years, two distinct families were reared at Lippizza, the old Italo-Spanish Lippizza breed and the Siglavi family, obtained by crossing pure-bred Lippizza mares with pure-bred Arabs. The blood was renewed again recently by the introduction of mares of oriental origin. In 1918, the stud consisted of some 80 mares and 5 stallions.

The Lippizza horses are from 1.37 to 1.65 metres high ; the expressive head has a slightly flattened nasal line, recalling its Spanish ancestry ; the neck is well set on the shoulders and the mane is long and thick. The shoulder, often too heavy, is a little defective as regards its setting and length; the chest is wide and deep and the withers are rather low; the back is straight, and the well-sprung back is wide and strong ; the cruppers are rounded and muscular ; the tail, well attached and provided with hair, is carried elegantly ; the limbs are well set a good shape and movement, and the tendons are well marked and clean. The strong, wide hocks are free from defects and the hoofs are excellent and well shaped.

The coat is generally grey. The animals are agile, strong very intelligent and of slow maturity (they are only full grown at 7 years), but of extraordinary longevity and resistance to fatigue up to a great age. Defects of the bones are almost unknown in these horses.

At Lippizza, the breeding season begins towards the middle of De-

cember and lasts to the end of April, so that the foals arrive in autumn, when the pasture is richest.

After weaning and after becoming accustomed to the halter, the foals born at Lippizza were taken to the rearing depot at Prestanegg, near Postumia, where a total of 108 to 180 foals were reared. After the first few weeks of life, the foals were given oats, at first in small quantities, then in amounts increasing according to the growth. Weaned foals were given oats even before they were put out to pasture. At one year of age, all animals of the Lippizza breed were branded under the left cheek with the letter *L*. Entires chosen for stud work were sent to Lippizza after 3 years at Prestanegg and were broken in, and at 4 years old they were sent to the Riding School of the Viennese Court to have their temper and strength tried. If these proved satisfactory, they were sent back to Lippizza to act as stallions, but if unsatisfactory, they were gelded and sent to Kadrub to be broken in and trained. Three-year old fillies suitable for use as brood mares were sent back to Lippizza, and, after a trial of their intrinsic qualities lasting a year, it was decided whether they were to be mounted or not. The rejected fillies, were then sent back to Prestanegg and, like the geldings of the same age, broken in at Kadrub.

When war broke out between Italy and Austria in 1915, all the Lippizza stud was taken to Vienna and later on almost wholly sold to private persons. In 1919, the Italian Government obtained over 100 Lippizza mares, stallions and colts, which will be used to reconstitute the ancient breed.

553 – **Improvement of Horse Rearing in Libia.** — MANETTI, C., in *L'Agricoltura coloniale*, Year XIV, Nos 2-3, pp. 90-115. Florence, Feb.-March, 1920.

True horse breeding does not exist in Libia, as the few rare groups, of horses found there belong to rich families from the coastal towns, or to some Arab chiefs from the interior, especially the Orfella tribe. Camels are exclusively used for transport on the caravan routes, the ass is used for total work, and the horse, especially in the furthermost oases, is entirely missing However, the country should be particularly suited to the production of horses, for the best Arab horses are produced in the poorest and most arid countries, and there was a time when horse rearing was of great importance in Libia. The lack of fodder is not irremediable, because the pastures which have been ruined by continuous neglect and excessive pasturing by sheep and goats can be improved, and even water for drinking places can often be obtained from the subsoil. The great relapse in horse rearing in Libia is due particularly to social and economic reasons, such as the prohibition by Turkey of the export of horses, so as to obtain supplies more easily.

The Libian horse is of the oriental breed, it is of medium size (a little below 1.50 metres high), with a weight varying between 300-400 kg.; wither high, back short, croppers very hollow, chest narrow, limbs and hoofs strong. Balance is nearly always defective, owing to bad method of rearing, the colts being shod and put to work too soon ; they are made to walk always at a trot, which gives them their bad shape, especially their

hollow cruppers ; an unsuitable system of turning them out to grass is used, etc. The predominating colour of the coat is light grey. Like the other Berber horses, the Libian horse runs and jumps well, and resists fatigue and privations ; it is particularly suited to military purposes.

In order to improve the existing stock of horses, it will first be necessary to select the local horses ; afterwards, it will be feasible to introduce improving blood in the shape of Berber horses from the adjoining countries, especially from southern Tunis. With present conditions, it is not yet the moment to make use of Arab or Sardinian-Arab stallions and still less of stallions belonging to improved and exacting European breeds.

The author thinks that two distinct Institutes should be established in Tripolitania and Cyrenaica ; one experimental, for investigating problems of rearing, acclimatisation, etc., and one executive, for propaganda work, and which would have special care of stallions for remount purposes, while taking charge of the practical improvement of the horses of the region by conciliating the needs and wishes of the breeders with national interest. The second Institute would also deal with the organisation of fairs, markets, syndicates of breeders mutual assurance societies against the loss of stock, hygiene, and sanitary administration. It would also control the breeding of mares belonging to colonial troops in its area.

Horse rearing should be specially directed towards the production of the war horse.

554 – **The Duration of Gestation in Mares of the Lippizza Breed.** — STAFFE, A., in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der Hochschule für Bodenkultur in Wien*, Vol. III, Pt. 3, pp. 547-594, 2 diagrams, bibliography of 33 titles. Vienna, December 20, 1918.

It cannot be denied that the duration of gestation has a certain significance from the standpoint of selection, seeing, that, as a rule, colts that have been procreated in a shorter time become better horses when they grow up.

The duration varies according to the breed, for early maturity breeds (western) have a shorter gestation period than breeds that mature later (eastern) Embryonic and postembryonic development thus have an analogous duration. The size of the breed, however, does not appear to be related to the duration of gestation.

Gestation is practically always longer for the birth of colts than for fillies, because the female embryo has a more active temperament, so that parturition begins earlier, especially because the female embryo grows more rapidly. Similarly, the postembryonic development of the female ends earlier.

In the same breed (kladrub Spanish compared with Lippizza mares, the duration of the foetal life of white colts and fillies is from 0.2 to 3.0 days shorter than that of brown or jet-black colts. The greater richness in dark pigment and the greater length of gestation represent original qualities, so that it is natural that the two characters should occur together.

The author has used the Lippizza stud book to work out the following periods of gestation :

Breed	Locality where reared	Period to which the data relate	Average length of gestation days	
			For the birth of males	For the birth of females
Lippizza	Lippizza	1828–1842	337.10	333.00
		1860–1870	338.30	337.69
		1906–1916	342.55	338.31
»	Radantz	1906–1916	338.00	338.30
Kladrub Spanish white	Kladrub	1877–1906	346.32	343.80
Kladrub Spanish jet-black.		1877–1906	346.76	344.00
Kladrub Spanish	Hochwald	1894–1903	338.18	337.00
Haflinger	Brioni	1911–1916	324.18	322.90
Huzulen	Radantz	1905–1916	324.00	339.00
Mountain Bosnian	Goražde	1906–1913	335.14	331.62
Shetland Pony	Berlin	1913–1916	409	

Under southern climates, the gestation period is shorter than in northern climates, but the removal of animals to a northern climate may lead to a shortinlng of the gestation period, owing to richer food.

The weight of colts at birth increases with the duration of foetal life.

Opinions so far expressed regarding the duration of gestation in primiparous are not in agreement. Many researches have been carried out on : (1) comparison, for 30 mothers, of the duration of the first gestation with the following ones ; (3) comparison of the duration of the first gestation with that of each successive gestation which gave a product of the same sex as in the first ; (3) comparison for 100 mothers, of the duration of the first and fifth generation ; for another 100 mothers, comparison of the duration of the first gestation on the one hand, of the 2nd, 10th and 1st. on the other. The results of these researches apparently show that, owing to the greater sexual potency of the young mother, the first-born have a shorter foetal life.

According to researches made at Kladrub and Mezöhegyes, mares covered by a jackass have a gestation longer than the normal, mainly because a longer time is required for the fusion and division of the cells on account of the difference in shape and number between the chromosomes. As a rule, twin embryos are born or abort, but there are exceptions.

Researches on the duration of gestation, made by the author at Lippizza, Radantz, Gorazde, and by Von Wellmann at Mezöhegyes and Fozaras, show that at the beginning of the parturition period, the length of gestation is shorter, even by 22 days, than at the end of that period. The opinion that temperature, pasturage, and external influences in general are the cause of this behaviour, is not tenable. The cause is rather the greater or lesser sexual potency of the mares at the time of serving, and at the beginning and end of the "heat" period. Greater sexual potency leads to a stronger development of the foetus.

The duration of different gestations in the same mare often shows but slight differences ; it thus becomes a true physiological character.

The typical duration of gestation is transmitted hereditarily as much by the mother as, in a latent state, by the father. A long gestation is dominant, in the Mendelian sense, compared with the average gestation and the short one, and the average gestation is dominant compared with the short gestation, as has been shown by the segregation of these characters in the 2nd generation. The process of heredity can be explained genotypically by the hypothesis of a factor **K** which expresses the tendency to a short gestation and of 2 homomerous factors of inhibition **H** and **I**.

555 – **The Increase in Weight of a Belgian Colt.** — Rossi, in *Giornale d'Ippologia*, Year XXXII, Nos. 11-12, p. 2. Pisa, June 16-30, 1919.

The weight of an animal is almost always related to its growth, and the growth is related to its earliness of maturity, which shows the interest attaching to the following figures giving the average increase in weight of 2 pure-bred Belgian colts, born and bred in Italy :

Colt No. I :	Weight at birth	75	kg.
	Weight at 10 months	423	»
	Average daily increase during the first 300 days of life	1.16	»
	Weight at 26 months	715	»
	Average daily increase between the first and second year	0.60	»
Colt No. II :	Weight at birth	71	kg.
	Weight at 8 months	330	»
	Average daily increase during the first 240 days of life	1.09	»
	Weight at 24 months	700	»
	Average daily increase between the first and second year	0.70	»

556 – **The Andalusian Breed of Cattle.** — Ulmansky, S., in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der Hochschule für Bodenkultur*, Vol. III, Part 3, pp. 457-546, Bibliography of 48 titles, 10 tables, 13 plates. Vienna, Dec., 1918.

The author went to Spain to study the various Spanish breeds of domestic animals, especially the cattle. In the present work he deals with the Andalusian breed of cattle, the most widely distributed and most important Spanish breed. He deals with the distribution, feeding and rearing conditions, the colour of the skin and the coat (there are 3 varieties : reddish-brown, black, and white), conformation, aptitudes (firstly work, secondly meat ; the breed is no use for milk production), the structure of the cranium, the origin, hypotheses as to the place occupied by Andalusian cattle in the zootechnical system, breeds with analogies to the Andalusian breed, and its history. The conclusions arrived at are given below.

The type of cattle distributed over more than three-fourths of Spain, the Andalusian breed (which also includes the " corrida " bulls), belongs to the species *Bos primigenius* and not to the brachycephalic type as has hitherto been supposed. The Andalusian ox even belongs to the purest and finest *Bos primigenius* type that has yet been studied. With its three varieties, which are identical except as regards coat colour, the Andalusian ox is the direct descendant of the aurochs and, to be more exact, of a variety of aurochs which is distinguished by having horns with a bony core.

From various points of view, characters of *Bos trochoceros* Meyer are to be found in the Andalusian ox.

There is nothing in Spanish history that lends colour to the theory that the type of the Andalusian breed was introduced in a domesticated state into the country. On the contrary all the evidence points to the conclusion that it originated from domestication of the indigenous wild ox, since it is autochthonous and is still to be found there in a pure state and almost half wild.

Apparently, the Andulusian breed is closely related to some of the some of the primitive English (Devons, Welsh,) Italian (Val di Chiana) and South American (Franquero) breeds.

557 - **The Illawarra Cattle of New South Wales.**— SUTER, P. H., in *The Journal of the Department of Agriculture of South Australia*, Vol. XXII, No. 5, pp. 378-381, figs. 2 Adelaide, December, 1918.

The breed of cattle known as Illawarra cattle, South Coast Shorthorns or Majors is a first-class dairy breed. It owes its first name to the fact that it was improved and fixed in the Illawarra district of New South Wales. It is a product of crosses between the Shorthorn, Ayrshire, Devons and longhorned roan cattle introduced from Ireland. Amongst the foundation stock that contributed greatly to its improvement, the author mentions a Shorthorn bull named Major and one of its descendants, Commodore. At present, the Illawarra breed closely resembles an ideal type of dairy Shorthorn.

558 - **Dairy Cattle in Southern China.**— LEVINE, C. O. (Canton Christian College), in *The Philippine Journal of Science*, Vol. XV, No. 1, pp. 91-104, 1 plate. Manila, July, 1919.

The only areas in Kwangtung where dairying has made any progress are the districts round Canton and Hongkong. Three species of dairy cattle — European breeds of cattle, buffaloes and zebus — are bred there. The dairies around these two towns utilise approximately 1600 cows, including about 1200 of European origin, imported from England, the United States, or Australia, and include the Shorthorn, Holstein, Ayrshire, Jersey and Guernsey breeds. The breed present in greatest numbers is the Shorthorn, especially the white variety. Pure bred animals are few in number, but crosses between European breeds and the native zebus are sometimes found. The European breeds are never allowed to graze for all the pastures are infested with ticks that transmit piroplasmosis, which is always fatal to imported cows, whereas their progeny, once acclimatised, soon become immune to the fever.

The buffaloes are mainly reared as draught and beef animals. The females which are milked do less work. There are no special breeds of dairy buffaloes. A milking cow fed on grass and grain will give milk for 8 to 12 months, the quantity produced per day varying between 3 to 15 lb., with an average for the whole lactation period of about 4.5 lb. a day. The small quantity is compensated for by its richness, as it contains 3 to 4 times as much fat as the milk of the European cow.

The native cow of southern China is a common Eastern variety of the humped species (*Bos indicus*). The hump is slight and is only 6 to 8 in., high in the bulls and less in the cows. The coat varies in colour from reddish yellow to brown-black ; white coats are not found and spotted ones are rare. The tongue, nostrils and teats are back. The bulls weigh from 800 to 1000 lb., the cows from 600 to 800 lb. The milk is richer than that of European breeds, but it is not as rich as buffalo milk. The amount of milk given is about as much or a little less, than that given by buffalo cows ; they are very docile and very few are milked. The humped species are meat and draught animals ; the hind quarters are full and deep and there is another deep layer of flesh on the back and cruppers.

The following are analytical data obtained by the author relating to milk :

	European cow.	Native buffalo cow.	Native zebu cow.
Fat	3.80	12.60	8.00
Protein	3.23	6.04	—
Sugar	5.96	3.70	—
Ash	0.82	0.86	—
Moisture	86.20	76.80	—
Total dry matter	**13.90**	**23.90**	—

A series of tables includes : The complete analysis of the milk of the buffalo cow and of the cow of European origin ; the fat content during several phases of the entire lactation period for 14 individual buffaloes, and detailed somatic measurements of 12 buffalo cows. The average fat content during the whole lactation period of each buffalo cow varied from 9.65 to 15.60 %.

559 - **An Experiment in the Rearing of Calves on Whey and Meals.**— Ministry of Agriculture and Fisheries, pp. 12 + 2 pl. London, April, 1919.

The food value of whey is usually considered to be too low to allow its use as a basal food for calves and for this reason it is given to pigs. But, in parts of England where cheese-making is of great importance, whey has been used to a certain extent in feeding calves, either given to calves kept at pasture or as the fleetings that rise to the surface when whey is heated. As information regarding this was scanty, the question was examined experimentally on behalf of the Ministry of Agriculture and Fisheries in the spring of 1918 by University College, Reading, under the direction of M. S. PENNINGTON.

The average composition of 1 litre of milk and 1 litre of whey was as follows :

	Whole milk	Whey
	gm.	gm.
Moisture	900	955
Fat	40	4
Protein	35	9
Sugar	49	52
Ash	8	7

Thus, to bring the food value of 10 litres of whey up to that of 10 litres of milk, 360 gm. of fat (fat or oil) and 260 gm. of albuminoids must be added as well as phosphates. There is practically only one food that is a good complement to whey, and that is linseed, 1 kg. of which furnishes 0.35 kg. of oil and 0.25 kg. of albuminoids. Cod-liver meal, the by-product obtained in the preparation of cod-liver oil, is also suitable as it contains 44.1 % of oil and 36.5 % of albuminoids, but it cannot always be found on the market.

In other experiments, the lack of fat in the whey compared with skim milk was compensated for, not by adding oil, but by adding a mixture of oil and starch or some other carbohydrate. Expressing the food value of milk and whey as starch equivalents, the deficit in food value of 10 litres of whey compared with 10 litres of milk is practically 1 kg. of starch.

In any case, a little precipitated bone phosphate is added to neutralise the acidity of the whey.

It was found that the foods caused no digestive troubles in the animals, and after investigating the question of digestibility, the following rations were adopted as complements to skim milk:

(1) Linseed meal + linseed cake (3 : 2).
(2) Linseed meal + bean meal + fish meal (3 : 3 : 1).
(3) Linseed meal + fish meal (2 : 1).
(4) Linseed meal + coconut cake (1 : 1).
(5) Bean meal + linseed cake (5 : 4).
(6) Linseed meal + fish meal + crushed oats (3 : 1 : 3).

With No. 1, the calves gave an average increase in weight of 3633 gm. per head per week from the 7th to 17th week; with No. 2, the increase was 4218 gm. The four other rations were fed to calves from the 2nd to the 17th. week, and gave respectively the following average increases in live weight, in gm. per head per week:

(1) For the 15 weeks of the experiment, 2289, 3030, 3193, and 2762 gm.

(2) For the last 10 weeks of the experiment, 3207, 3361, 3633, and 3329 gm.

In each experiment, the complementary ration was given at the rate of 1 kg. per 10 litres of milk, while the calves were given hay ad lib. and were finally put out to grass.

The whey was heated to 37° C, and 30 gm. of precipitated bone phosphate was added to every 10 litres of whey.

These complementary rations were found to be nearly equal in value, although that containing bean meal showed a slight superiority.

The results show that after 4 weeks calves can be given hay ad lib. and, when they can eat it, linseed cake or a mixture of coconut cake and gluten feed is added beginning with 60 gm. per head and going up to 240 gm.

The system of feeding should be as follows :

From birth to 2 weeks : colostrum followed by the first milk produced.

From 2 to 4 weeks : After the second week, the whole milk is gradually replaced by whey and the above-mentioned mixtures in the right proportions. The quantity of substitutes is increased each day and the milk decreased until, at 4 weeks, the calf receives 4.5 litres of whey, 450 gm. of the complementary ration and no milk. At first the mixture should be mixed with the milk, but as soon as the calves can eat it alone, it must by given separately, and the whey to which precipitated bone phosphate has been added must be given as a luke-warm drink.

From 4 to 5 wecks : Continue the ration of 4.5 litres of whey and 450 gm. of the complementary ration per head per day and give now hay ad lib.

From 6 to 7 weeks : The above-mentioned ration is increased by giving linseed cake or a mixture of linseed cake, coconut cake and gluten feed at the rate of 60 gm. per day given after the morning meal, the quantity being gradually increased to 240 gm. per head per day.

From 8 to 9 weeks : Increase the amount of whey given daily to 6.80 litres and the supplementary ration to 680 gm. per head per day.

From 10 to 12 weeks : Give the whole ration.

From 13 to 14 weeks: Gradually reduce the supplementary ration from 680 gm. to 450 gm. per head per day, while giving the same amounts of the other food.

From 15 to 16 weeks : Reduce the whey to 4.5 litres and the supplementary ration to 230 gm. per day, so that the calves are given 4.5 litres of whey, 230 gm. of the supplementary ration, 170 gm. of cake (or cake mixture), and hay ad lib.

After the 17th week: If the calves can be put out to grass or if succulent fodder is available, no whey or supplementary ration need be given at the end of the 17th week, but, in this case, the cake given must be increased to 230 gm. per head per day.

If, while whey is being fed to the calves, it produces much wind, this can be avoided by adding a little precipitated carbonate of lime to the whey.

560 – **Swine-Feeding Investigations in Kansas (1918-1919)** — Mc CAMPBELL, C. W., FERRIN, E. F. and WINCHESTER, H. B., in the *Kansas Agricultural Experiment Station*, Circular 78, pp. 1-8. Topeka, October, 1919. PIGS

I. SELF-FEEDING VERSUS HAND FEEDING. — Experiments intended to demonstrate the value of free feeding compared with hand feeding in fattening 75 lb. pigs and to show at the same time the amount of tankage required to supplement a maize ration.

Method. — Twenty pigs of uniform age, weight, quality and condition, were divided into 2 groups of 10 each and placed in dry lots. The first group fed from a self feeder, provided with a compartment for shelled maize and another for tankage ; the second group was given, twice a day, as much as they could eat of a mixture of 10 parts of shelled maize and 1 part of tankage. Both groups were watered twice daly. The experiment lasted 100 days. The initial weight was taken as the average of the first three days and the final weight as the average of the last 3 days. The animals were bought at the market, and were sold there at the end of the experiment ; all the expenses due to fattening and to the experiment were calculated.

TABLE I. — *Self feeding versus hand feeding* (100 *day experiment*).

Results. — The results, given in Table I, show that the first group ate more maize and less tankage than the second ; the quantity of tankage needed to obtain the best results was reduced to 5 % of the maize. The more economical increase of weight is probably due to the fact that

TABLE I. — *Self-feeding versus hand feeding.*

Lots	I	II
Rations	Maize + tankage	Maize + tankage
Feeding	Self feeding	Hand feeding
	Pounds	Pounds
Initial weight per pig	74 0	79.2
Final weight » »	256.8	204.3
Increase in weight per pig	182.8	125.1
Daily increase in weight per pig	1.828	1.251
Daily ration per pig:		
Maize consumed	5.954	4.770
Supplement	3.227	0.477
Food consumed per 100 kg. gain in live weight:		
Maize	325.71	381.29
Supplement	17.65	38.13
Cost per 100 lb. gain in live weight $	10.067	12.669
Initial cost per pig »	15.00	15.00
Cost of food per pig »	18.4039	15.8364
Cost of labour »	1.00	2.00
Interest on capital, per pig, at 8 % »	0.3287	0.3287
Cost of vaccination per pig. »	0.59	0.50
Equipment, etc. »	0.25	0.25
Total cost per pig. »	**35.4826**	**33.91**
Sale price per cwt »	16.60	16.50
Sale price per pig »	42.63	33.71
Profit or loss per pig. »	7.15	0.20

Prices of foods: — Maize $1,58 per bushel; tankage $100 per ton.

with self feeding the animals took the food more often and made a better use of it.

II. — SEMI-SOLID BUTTERMILK VERSUS TANKAGE, LINSEED MEAL PEANUT CAKE AND ALFALFA HAY AS THE SOLE SUPPLEMENTARY SOURCE OF PROTEIN MAIZE FOR FATTENING SWINE. — The special aim of this experiment was to study the food value of commercial semi-solid buttermilk in fattening swine on maize as a protein supplement.

Method. — Fifty pigs, bought at the market, and of uniform weight, quality and general condition, were divided into 5 lots of 10 each. All the lots were hand fed and the rations of each lot were calculated so that all the feeds cost the same

TABLE II. — *Pig-feeding experiments with semisolid buttermilk compared with tankage, linseed meal, peanut cake and alfalfa hay as sole supplementary source of protein to maize in fattening pigs.*

Lots	I	II	III	IV	V
Protein Supplement	Tankage	Semi-solid butter-milk	Linseed meal	Peanut cake	Alfalfa hay
	Pounds	Pounds	Pounds	Pounds	Pounds
Initial weight per pig	79.2	79.8	79.5	79.6	81.4
Final weight per pig	204.3	190.6	195.0	197.0	198.3
Gain in weight per pig	125.1	110.8	115.5	117.4	116.9
Daily gain per pig	1.251	1.108	1.155	1.174	1.169
Daily ration per pig:—					
Maize	4.770	4.770	4.770	4.770	4.770
Supplement	.477	.5962	.795	.795	1.197
Food consumed per 100 lb. gain in weight:—					
Maize	381.29	430.50	412.98	406.30	408.04
Supplement	38.13	71.75	68.83	67.71	127.21
Cost per 100 lb. of gain in live weight $	12.659	14.292	13.711	13.489	13.106
Initial cost per pig »	15.00	15.00	15.00	15.00	15.00
Cost of food per pig »	15.8364	15.8364	15.8364	15.8364	15.3226
Cost of labour »	2.00	2.00	2.00	2.00	2.00
Interest on investment, per pig, at 8 % »	.3287	.3887	.3287	.3287	.3287
Cost of vaccination per pig »	.50	.50	.50	.50	.50
Equipment, etc. »	.25	.25	.25	.25	.25
Total cost per pig »	**33.91**	**33.91**	**33.91**	**33.91**	**32.40**
Sale price per cwt. »	16.50	16.50	16.40	16.30	16.20
Sale price per pig »	33.71	31.45	31.98	32 50	32.12
Profit or loss per pig »	— .20	— 2.46	— 1.93	— 1.41	— 1.28

Prices of foods : — Maize, $1.58 per bushel ; tankage, $ 100 per ton ; semisolid buttermilk, $ 80 per ton ; linseed meal, $60 per ton ; peanut cake, $60 per ton ; alfalfa hay, $25 per ton.

Results. — The results, given in Table II, show that the cost of an increase in live weight of 100 lb. was lowest for the group fed on tankage and

highest for the group fed on semi-solid buttermilk, as sole supplementary sources of protein for pigs of an average weight of 80 lb.

Consequently, Lot I gained most in weight and Lot II gained least. There was not a great difference in the final degree of fattening attained by Lots I, II and IV, whilst Lot III, fed on linseed meal, attained a less finished state of fattening, which may be due to the fact that the food was not very attractive to the animals. With alfalfa, the pigs grew better, but the final fattening was less satisfactory, which considerably diminished the unit price of the animals fattened in this way, though the unit price of the gain in weight with alfalfa was slightly higher than the price obtained with tankage. Further experiments will be carried out to see if, by combining the foods thus tested singly in different ways, it is possible to obtain more economical results in fattening.

III. — Rearing pigs born in autumn. — Experiments made with the object of collecting data regarding the rearing of pigs in autumn, especially from an economic standpoint.

Method. — Thirty young pigs were divided into 6 lots of 5 each. They were all born in autumn, and over half at the end of October. All the lots were fed on shelled maize, with the following supplementary albuminoids :— lot I tankage; lot IV linseed meal; lot II tankage and middlings; lot V linseed meal and middlings; lot III tankage, middlings, and semisolid buttermilk; lot VI linseed cake, middlings and semisolid

Table III — *Results of feeding pigs born in autumn,*

Groups		I	II	III	IV	V	VI
Initial weight per pig		53.5	56.06	55.34	56.4	50.3	56.4
Final weight per pig		126.6	152.26	184.34	121.74	139.85	174.66
Daily gain in weight per pig		.81	1.07	1.43	.73	.99	1.31
Food consumed per 100 lb. of gain in live weigt :							
Maize		364.67	297.87	243.06	407.10	269.76	224.21
Albuminoid supplements							
Tankage		47.20	25.36	19.38	—	—	—
Wheat middlings		—	90.07	94.77	—	82,40	79.95
Semisolid buttermalk		—	—	53.02	—	—	59.19
Linseed meal		—	—	—	65,58	52,03	25.83
Total food consumed per 100 lb. of live weight		**411.87**	**413.30**	**410.23**	**472.68**	**404.19**	**389.18**
Cost per 100 lb. of weight gained	$	12.63	11.61	11.76	13.33	11.41	11.17
Final cost per pig	»	22.78	27.40	33.18	21.91	25.17	31.44
Cost of food per pig	»	9.25	11.17	15.20	8.71	10.22	13.21
Initial cost per pig	»	9.59	10.09	9.96	10.15	9.05	10.15
Gain on initial cost plus cost of food	»	3.94	0.14	8.06	13.05	5.90	8.08

Valuation of feeds: shelled maize $1.54 per bus.; tankage $5.50 per 100 lb.; linseed meal $3.25 per 100 lb.; semisolid buttermilk $4 per 100 lb.; wheat middlings $2.25 per 100 lb.

buttermilk. Self-feeders were used, but she semisolid buttermilk was given ad lib. twice a day.

Results. — The results, given in Table III, show that the greatest increase in weight was in every case obtained with tankage. The addition of middlings had a useful effect. The addition of buttermilk for lots III and IV gave greater gains in weight and a greater margin of profit. Further, the experiment showed that, for successful winter rearing, farrowing, should not take place later than September so that the animals will be sufficiently grown when the first winter cold appears. There should be a warm, dry shelter, with good straw litter free from dust, to avoid any risk of the young pigs catching pneumonia. During the coldest periods, the gain in live weight was very small.

The experiments will be continued next winter, in view of a subsequent study of the different combinations of feeds.

POULTRY

561 - **The Physiological Relationship between Fecundity and the Natural Yellow Pigmentation of Certain Breeds of Fowls.** — PALMER, L. S. and KEMPSTER, H. L., in *The Journal of Biological Chemistry*, Vol. XXXIX, No. 2, pp. 313-330, 2 plates. Baltimore, M. D., September, 1919.

It has long been observed that there is a close relation exists between the quantity of yellow pigment visible on the shanks, ear lobes and beaks of certain breeds of fowls such as European (Leghorn) or American origin (Plymouth Rocks, Wyandottes, Rhode Island Red) and the number of eggs previously laid by them. It has been suggested that this correlation should be used in selecting good laying hens (1).

According to BARROWS (*Maine Agricultural Experiment Station Bulletin* 232, p. 237, 1914), the yellow colour of fowl's legs is due to deposits of yellow fat in the Malpighian layer of the epidermis : and PALMER (*Journal of Biological Chemistry*, Vol. XXIII, p. 261, 1915) has shown the existence of a physiological relationship between the xanthophyll of plants and the lipochrome in egg yolk, blood serum, and in the body fat of the hen. But the researches described in the present paper show that the fading of the yellow pigmentation in the visible parts of the skin due to fecundity is not due to the removal of pigmented fat from these parts and its passage to the egg-yolk, but to the deviation of the secretion of xanthophyll, which takes place in the egg and not in the parts mentioned ; these parts gradually lose their colour, partly by oxidation, and partly by the wearing away of small pieces of the skin.

Full grown cockerels were fed on a ration free from carotinoids (white maize + skim milk) ; after a certain time, a food containing carotinoids (substitution of red or yellow maize for the white maize, or by adding grass) was added to the ration, and the effect of these foods on the disappearance or reappearance of pigmentation and on the activity of egg formation was studied. The egg yolk, blood plasma, and sub-epidermal fat were colorimetrically examined and the skin of the claws, coloured deep

(1) See *R.* June, 1915, No. 631 ; *R.* Feb., 1916, No. 207 ; *R.*, April, 1918, No. 448. (*Ed.*)

yellow, was studied histologically. The following conclusions were arrived at:—

The fading of the yellow pigmentation from the ear lobes, beak, shanks, etc., in Leghorn and American fowls during fecundity is due to the fact that fecundity deflects the normal path of xanthophyll excretion from these parts of the epidermis to the egg yolk. The xanthophyll deposited in these epidermal parts gradually disappears on account of the natural physiological change in the structure of the skin. The thicker the epidermis, the slower the disappearance of xanthophyll.

The xanthophyll in the above-mentioned parts of the epidermis is mainly present in a granular form, associated with little or no fat. It occurs especially in the Malpighian net-work, but it also exists in the subcutaneous blood-capillaries.

Xanthophyll cannot be restored to the fowl's skin as long as fecundity lasts, no matter what excess of pigment the fowl is made to ingest. The adipose tissue does not store xanthophyll derived from the food during the period of egg formation, even when rations rich in xanthophyll are given, because the pigment is entirely excreted in the egg yolk.

The fading of the colour of the ear lobes, beak and shanks of fowls resulting from egg laying is an index of *continuous* fecundity only and not of *heavy egg laying* The yellow colour of those parts just after the end of the laying season indicates either intermittent fecundity or a more or less recent loss of fecundity, during a period sufficiently long for the xanthophyll to be restored to the body.

562 – **The Effects of Castration on Cockerels.**— LAURIE, D. F., in the *Journal of Agriculture of South Australia*, Vol. XXII, No. 1, pp. 40,-43. Adelaide, August, 1918.

The question of the regeneration of the testicles after castration has aroused great interest of late, as the fact is related to problems of genetics. For this reason, the author again took up some experiments that he had carried out some 30 years ago.

It was then believed that, to destroy the testicle, it was sufficient to extirpate it by crushing it and removing as much as possible of its contents, but later it was realised that the capsule might be left intact and thus regenerate the secretive tissue and the seminal ducts of the testicle. The author found this occurred on several occasions. He has repeated old experiments with young White Leghorns, Rhode Island Reds, Barred Plymouth Rocks, from which one or both testicles were removed, either completely or only in the intracapsular portion. Only in the first case did the cocks assume the characters of normal capons, i. e., lengthening of the legs, longer and more abundant plumage, head of a neuter appearance. When one testicle is completely removed, the second regenerates itself and takes on a normal size and shape, that is sometimes normal or almost normal, sometimes different and smaller. When the two testicles are only crushed, they regenerate themselves ; the external sexual characters remain unchanged. This constitutes a marked difference between birds and mammals.

The author enters into considerations on the internal organs of secretion and the influence of hormones.

The testicles, like the ovaries, are organs of internal secretion and elaborate substances similar to enzymes, which have a profound effect on growth, general development, characters, etc., and, in certain cases, a reciprocal action takes place between them. The removal, loss, or modification of one or the other of them has serious effects on the organism, or principally on another organ of internal secretion.

As regards the testicles, total extirpation, including the removal of the capsule, deprives the bird of the organs that elaborate the hormones which influence the development of the secondary sexual characters in the male. In the case of ovariotomy, the phenomenon is more complex: in certain cases, the removal of the ovary (there is only one in the fowl) leads to the assumption of male characters and the formation of a testicle. The ovary owes its origin to the DE GRAFI follicles and it is obvious that these regenerate themselves normally, at least in the fowl. It is supposed that this is due to the development of the aptitude for egg-laying in the fowl. There is also reason for believing that selection plays a part as regards the aptitude for sperm formation of the male sexual glands regenerated in poultry. Partial removal of the ovary may lead to degeneration. The destruction of the ovary suppresses the organ which produces the hormones that prevent the appearance of the secondary sexual characters of the male, and these appear for that reason. These facts confirm the supposition that "feminality" is a supernumerary character to "masculinity", and, if the former is removed, the second remains ; it is apparently a case of two Mendelian characters.

Other internal secretory organs, such as the thyroid, thymus, pituitary and pineal glands, are influenced by castration.

563 - **Feeding Experiments with Pullets and Hens.** — PHILIPS, A. G., in *Purdue University, Agricultural Experiment Station, Bulletin* No. 218, pp. 20 + 40 figs.; Lafayette, Ind. August, 1918 and No. 227, pp. 3-28 + 7 figs., 1919.

I. — *The Value of Skim Milk and Meat Scraps for White Plymouth Rocks.* — The results are reported of feeding experiments with pullets and with hens. The experiments with pullets, conducted for 3 consecutive years beginning in December 1914 included an annual series of 3 pens, each receiving a mixed grain ration made up of maize and wheat, 10 lbs each, and oats 5 lbs with a dry mash consisting of 5 lbs each of bran and shorts. In addition to this allowance one pen received 50 lbs of skim milk and another pen 3.5 lbs of meat scraps, these quantities furnishing approximately the same amount of protein. During the winter the maize was increased to 15 lbs, the wheat reduced to 5 lbs, and in the fall 1 lb of oil meal was added. Grit, oyster shell and ground bone were always available as was also water, except in the skim milk pen. When not on range the birds were fed with mangels. The skim milk was fed in an open pan and the meat scrap was mixed with the mash. There were 30 pullets in each flock.

The consumption of feed of the meat scraps pen was 97.63 lbs of feed per fowl at a cost of $1.69; the no-meat-food pen was 83.24 lbs at a cost of

$1.37 and of the skim-milk pen 201.82 lbs at a cost of $1.79. Of the feed consumed in the latter pen, 115.74 lbs was milk.

All birds tended to consume a similar amount of grains and mash regardless of whether they were good or poor layers. It was the addition of skim-milk or meat scraps to the ration that increased the efficiency of the grain.

The cost of feeding a Plymouth Rock pullet on a good ration averaged about $1.75 for the year 1916 but during 1917 this cost increased to nearly $2.50.

It cost an average of $0.155 to produce a dozen eggs in the skim-milk pen, $0.152 in the meat scraps 'pen and $0.275 in the check pen. It cost less to feed a pullet when no skim-milk or meat scraps was fed, but it cost more to produce a dozen eggs.

The amount of dry matter required to produce 1 lb. of eggs in the skim-milk pen was 4,9 lbs; in the meat scraps pen was 5.14 lbs and in the no-meat-food pen was 9.57 lbs.

The egg production averaged 140.2 eggs per pullet for the skim-milk, pen, 135.9 eggs per pullet for the meat scraps pen, and 61.2 eggs per pullet for the check pen.

All birds tended to lay the most eggs in or about the month of April whether well or poorly fed; and whether good or poor layers.

The profit over feed in the skim -milk pen was $1.59; in the meat scraps pen, $1.62; and in the no-meat-food pen, $0.05.

The feeding value of skim-milk for Plymouth Rock pullets was $1.60 per 100 lbs and of meat scraps was $20.03 per 100 lbs.

The meat scraps pen produced better fertility but not as good hatching power as the skim-milk pen. Birds receiving neither skim-milk nor meat scraps produced eggs of the best fertility (1).

A Plymouth Rock pullet produced about 27 lbs of fowl's dung in a year at night.

The method of feeding had no influence on the health or mortality of the flock. At the close of the first and second years of the experiments above described the check pens were also retained and continued on their ration another year. This was done to determine whether or not the poor egg production in the check pens has been due to the lack of animal protein or to poor laying powers in the particular birds. The results secured in this test the following conclusions:

Under normal conditions, hens consume about as much food as pullets. Hens that have been starved for animal protein as pullets, increase their consumption of everything as hens, when fed with milk in abundance. It costs but slightly less to feed a hen than a pullet.

When fowls are supplied with sufficient animal protein all their lives they normally lay less eggs as hens than as pullets. Fowls that do not receive sufficient animal protein as pullets, lay poorly, but when given skim-milk as hens they lay as many if not more, eggs than pullets

(1) See also *R.* Febr. 1920, No. 238. (*Ed.*)

normally produce. A fowl's egg capacity cannot be judged by the number of eggs she lays unless she receives a normal ration. The no meat-food pullets molt early and are in full new feather by October. When skim-milk is added to their ration in November, they respond quickly by laying more winter eggs as hens than any fowls did as pullets.

Early molting indicates poor laying, but it may not indicate poor laying ability. Hens not fed with milk as pullets produce more income and profit than those fed as hens, compared with milk-fed pullets. Hens seemed to produce better fertility than pullets, but showed little improvement as regards hatching capacity

II. — *Feeding Experiments with Leghorns.* — Feeding experiments with White Leghorn pullets during the years 1914-15 to 1917-18, and studies of the influence of confinement on egg production made in 1913-14 with hens and in 1914-15 with pullets are reported. The grain and mash rations and general treatment were the same as in the contemporaneous Plymouth Rock experiments above reported. Three pens of 30 birds each were used in each of the six experiments.

The first two experiments were duplicates. One pen received 5.3 lbs of cottonseed meal mixed with the mash, another had 50 lbs of buttermilk to drink for each 35 lbs of standard grain and mash, while the third received 50 lbs of buttermilk and a double allowance of grain, making the ratio of grain to mash 5 : 1.

The other two feeding experiments also duplicated each other. One pen was fed with only the standard grain and mash, while the second and third received in addition 3.5 lbs of meat scraps and 3 lbs of tankage, respectively. It was estimated that equal amounts of animal protein would be furnished to the latter pens. The main results of the feeding experiments are summarized in the following table :

Annual Egg and Feed Records per Bird of Leghorn Pullets during Feeding Experiments.

Averages of first and second experiments				Average of third and fourth			
Addition to Standard Ration	Number of eggs	Grain and mash consumed	Total feed per lb of eggs	Addition to Standard Ration	Number of eggs	Grain and mash consumed	Total feed per lb of eggs
Cottonseed meal . .	55.7	50.2	9.05	Meat scrap	179.1	70.5	3.77
Buttermilk	168.9	63.1	7.77 *	Tankage	183.5	71.3	3.60
Buttermilk and grain	137.9	64.2	7.25 *	None.	59.5	62.0	9.32

* Liquid buttermilk computed at 10 per cent. of its weight.

Cottonseed meal is considered practically worthless as a protein concentrate for egg production The egg records of the birds receiving it were especially low during the winter.

In the experiments on the influence of confinement it was found that birds kept housed continuously averaged 112.3 eggs per year, those with access to a small yard (10 by 80 ft) 124.4 eggs, and those with access to free range (130 by 160 ft) 128.75 eggs.

564 – **Feeding Laying Hens without Wheat or Middlings, in New Zealand.** — BROWN-F. C., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XVI, No 6 pp. 331-333. Wellington, June, 1918.

A series of feeding trials of laying hens was undertaken at the Poultry Station at Milton (New Zealand) from 1915 to 1918. The fowls belonged to both light (White and Brown Leghorns) and heavy (Black Orpington and White Plymouth Rock) breeds. The question was whether heavy egg laying could be obtained without feeding either wheat or middlings. The results agreed well and were affirmative. In a year a group of White Leghorns and another of Brown Leghorns which were given wheat and middlings, laid, respectively, 239 and 243 eggs per bird. Two similar group, which were not given these foods, laid 238 and 241 eggs per bird, respectively. The following year, the averages for the four groups, always kept on the same rations, were 159, 179, 175, and 201.

In experiments with the heavy breeds, the groups that received no wheat or middlings actually laid more eggs than the groups that did have those foods, as will be seen from the following Table :

Feeding tests with heavy breeds (*May* 1, 1917-*April* 30, 1918).

Breed	Average No. of eggs per head per year	Food consumed		kg
Black Orpington .	200	Middlings	Mash	320
		Bran		92
		Maize flour		120
White Rock . . .	198	Meat and bone meal		33
		Meat and bone meal (given separately)		45
		Wheat		464
		Alfalfa meal	Mash	250
		Bran		90
Black Orpington .	210	Maize meal		100
		Crushed oats		120
White Rock . . .	216	Meat meal		34
		Meat meal (given separately)		50
		Whole oats		440

Alfalfa meal, bran and oats are thus excellent substitutes for wheat and middlings for heavy and table breeds.

The food was given in the following way: In the morning, the mash was made with hot water, as much being given as could be consumed without waste, and, in addition, meat meal placed in a separate trough. At noon, the green food, especially chopped alfalfa, was distributed ; in winter, it was replaced by turnips or mangels given whole. At night, the grain was strewn on the straw litter. Gravel, coarse sand, broken oyster shells and clean water were always available for the hens.

BEE-KEEPING

565 - **Bee-keeping in Morocco.** — JEAMMET, in *L'Apiculteur*, Year 63, No. 9, pp. 217-219. Paris, September, 1919.

On account of its climate and rich flora, Morocco is well suited to bee-keeping. The Doukkala region, situated in the district behind Mogador, Souss and the Middle Atlas, produce a great deal of honey, but as the natives consume large amounts, the production does not cover the demand.

" Mobile " bee-keeping either does not exist in Morocco, or is represented by a few isolated experiments, but fixed bee-keeping, practised by the natives in a primitive way, has attained a high degree of development. The average yield per hive is very high, i. e., 50 to 70 kg. per annum.

The extraction of the native honey is often not cleanly, the bees and nest being crushed together and put into recipients of doubtful cleanliness, so that the honey sometimes has an unpleasant taste. But honey extracted under cleanly conditions with a centrifuge is exquisite and of flavour varying with the district where it is gathered, on account of the diversity of the flora. The honey gathered from Euphorbiaceae by the bees should be noted, as it burns the throat, and though of fine appearance, nothing suggests its taste.

The Moroccan honey flora includes the following plants, the best being printed in *italics* :— orange, mandarin, lemon, cedrate, quince, pear, peach, apple, cherry, apricot, *almond*, pomegranate, locust-tree, eucalyptus, ilex, cork-oak, *Judas tree*, " arganier ", *Myoporum*, beans, pea, chick-pea, all cereals, flax, wild or cultivated leguminosae, " minette ", sainfoin, clover, lucerne, mustard, *Spanish broom*, wild Resedaceae, corn poppy, poppy, mallow, honeysuckle, fennel, cactus, aloes, olive, palm, many Labiatae, *rosemary*, *lavender*, sage, *thyme*, *hyssop*, balm, mint, marjoram, etc.

566 - **Bee-keeping as a Source of Profit to the French Tropical Colonies.** — *L'Agronomie Coloniale, Bulletin mensuels du Jardin Colonial*, New Series, Year IV, 1919-1920, No. 27, pp. 86-87. Paris, November-December, 1919.

Up to the present, little interest has been shown in bee-keeping in the tropical colonies of France, though it would not take much to increase largely the production of honey and especially of wax, which finds a ready, sale at prices which would allow its transport from distant regions. It would be of a certain value in various areas of central Africa, especially in the interior of Equatorial Africa, the Middle Congo and Oubanghi.

According to the export statistics of the French colonies for 1917 (*L'Agronomie Coloniale*, No. 22, Jan.-Feb. 1919), the total exports of wax for that year amounted to 787 207 kg., of which Madagascar supplied 502 633 kg., French Guinea 213 800 kg., and Senegal 63 093 kg.

Wild bees are found everywhere, and abundantly in tropical regions and, though their products are the subject of trade in certain districts, there is no true apiculture, as the natives simply collect the honey and wax in the brush, often by destroying the colonies of bees.

The following information, furnished by the French Chargé d'Affaires at Haiti, shows the profit that could be derived from rational bee-keeping, which has given excellent results in Haiti where, owing to the high prices reached by honey during the war, bee-keeping has considerably developed of late.

An apiary does not cost much and gives comparatively large returns. The cost of maintenance is estimated at 8 fr. per hive per year. Exact information on this question has been collected, as an enterprise of this nature might be well suited to certain types of mutilated soldier. France imports fairly large amounts of honey from Haiti and St. Domingo, and apparently it would be worth while to establish the industry in the French colonies. Bee-keeping, in fact, gives better results in the tropics, as the bees can work all the year round.

During March, 1919, Haiti exported 38 308 kg. of honey (16 014 kg. to the United States and 22 294 kg. to France), as well as 1333 kg. of wax, worth 5720 fr., all of which went to the United States. The capital required in Haiti to establish an apiary of 100 hives is estimated at 5200 fr. The Haitian bee-keepers usually prefer " Italian " bees, as they are more active and resistant. A hive produces from 50 to 65 litres of honey and 0.9 kg. of wax per annum and will, it is estimated, yield a profit that represents about 40 % of the capital invested.

567 - **Italian Honey.** — *Bollettino di Notizie Commerciali, Ministero dell'Industria, del Commercio del Lavoro*, Year XLV, No. 18-19, p. 593. Rome, October, 1919.

Much Italian honey was exported before the war ; during the war, it has been more widely used and has found a variety of new applications. It partly replaced sugar as human food and as an industrial material and, consequently, the export not only stopped, but honey was imported from the United States. Wholesale prices which, until 1914, averaged about 80 to 90 fr. per quintal, rose to 950 fr. in 1918, and some sales were even made at 1200 fr., a price that was not reached on any foreign market. At the end of the 1918-1919 season, the average price was 600 fr. a quintal, but a drop is expected for the 1919-1920 season, as American honey is being offered at 350 fr. per quintal, free of customs, on Italian railway wagon. Spain is also offering white honey extracted by the centrifugal process. This price should be compared with that of white crystallized sugar, which is 455 fr. per quintal ; usually, the price of honey is a third less than that of sugar.

Italian honey, extracted by the centrifugal process, is the best in the world. Its indisputable superiority is mainly due to the flora, according to which there is some variation in the quality of the honey. Honey from localities planted with citrus plants has a pleasant taste, and is fragrant and slightly acid ; that from acacias and limes is exquisite and white

that from Labiatae is aromatic and clear yellow ; that from woods is not very tasty ; that from heather and buck-wheat is brownish-red, sweet, but not of very good quality ; that from tree nectar is dark brown and ordinary ; that from the arbutus, which is gathered in Sardinia, is bitter ; that from sulla lacks fragrance, but is much liked for its sweet taste and because it is liquid and limpid in summer, solid and white as snow in winter. The nectar or pollen bearing plants, or both, of the Italian flora are very numerous and chiefly belong to the following families : Aurantiaceae, Rosaceae, Leguminosae, Labiatae, Boraginaceae, Cucurbitaceae, Amentaceae, Polygonaceae, and Compositae.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

568 – **Foundation of an Experimental Institute of Agricultural Mechanics in Italy.** — *Gazzetta ufficiale del Regno d'Italia*, No. 70, pp. 9966. Rome, April, 3 1920.

The decree-law No. 325 of March 7, 1920, authorised the Italian Government to establish, in co-operation with public and private institutions, an experimental institute of agricultural mechanics, in order to help national agriculture and industry. The institute will be declared as of public utility and will be supervised by the Ministry of Agriculture.

The object of the institute will be to help, by means of researches, control, and advice, in securing improvements in agricultural machinery and plant, and to help in diffusing their use under the conditions most suitable for the different regions of Italy.

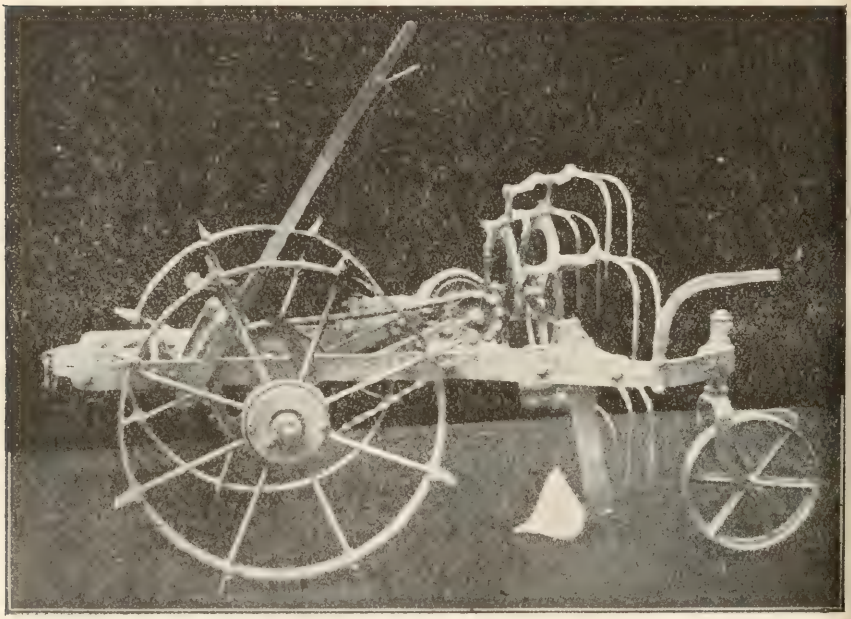
The institute will be most active at places and in periods where agricultural work is in progress, and will be centred at the Higher School of Agriculture, Milan.

The State will contribute 100 000 lire towards the foundation of the institute and will pay 50 000 lire a year towards its upkeep. The contributions of public and private institutions towards the cost of founding and maintaining the institute will be fixed by special agreements, and a series of Rules for the working of the institute will be drawn up at a later date.

569 – **Bamlett's Potato Digger.** — *The Implement and Machiney Review*, Vol. 45, No. 540, pp. 1793-1797, fig. London, April 1, 1920.

The Bamlett's Potato Digger is fitted with a special hitch, and can be drawn by horses-attached by means of whippletrees — or by a tractor, and it is claimed that the elimination of a pole or shaft means great economy in space at the headlands. Clean digging is produced by the special arrangement and construction of the tines, which, as nearly as possible, reproduce the action of the hand-fork. In this way the potatoes are " combed out " and not dragged with great lumps of earth. Nor are they scattered about, but laid with evenness and regularity. The tines are at the rear of the mechanism, and are long and curved. The tine-bearings are not near where the tines enter the earth but carried well away from the dirt and dust. Should the tines strike hard rock, stone, or, any other severe obstacle, they are so arranged as to have an elasticity of mo-

ment which lifts them clear of such bodies. This flexibility is due to the fact that the tines have not got a rigid centre, so that a certain amount of play is allowed. The digger is chain-driven, and the speed of the tines can be changed by the introduction of different size sprocket-wheels. In this way the speed of digging can be regulated to suit the speed of the horses or the nature of the soil, or both.



BAMBLETT'S Potato Digger.

The bevil-gear is mounted in a one-piece bracket. The chain is of the enclosed joint-pin type. A renewable unbreakable steel point is fitted to the share. By the use of a long lever the share can be adjusted while the digger is travelling, and the same lever also raises or lowers the share and line of draft when turning at the headlands. A constant level of work can be maintained by the manipulation of the rear wheel, which acts in much the same manner as a friction wheel at the rear of the sole plate of a plough.

570 - **Motor Hay Waggon.** — DESSAISAIX, R., in the *Journal d'Agriculture pratique*, Year LXXXIV, New Series, Vol. 33, 1920, Vol. I., Nos. 12-13, pp. 220-221. Paris, March 18-25, 1920.

The use of motor lorries for the transport of forage presents certain difficulties on account of the large volume that has to be loaded on the lorry so as to get a sufficient load to justify the purchase of the vehicle, which entails a considerable sum.

To do this, the "Société SCEMIA" makes use of the C. G. O. SCHNEIDER body, which has been developed jointly by the "Cie. générale des omnibus de Paris" and the "Etablissements SCHNEIDER et Cie." of Creusot.

The 5-ton chassis has a 34 H.P., 4-cylinder engine (bore, 0.105 mm.; stroke, 0.150 mm.; 1000 revs. per minute).

The wheels, in cast steel, like those of the Paris bus, can take 900 × 140 solid tyres on the front wheels and double 950 × 160 tyres on the

Motor lorry.

back wheels. The speeds are 6800, 12 800, and 22 600 metres per hour and the reverse runs at 5 000 metres per hour.

The chassis itself is 7 m. long, 2.25 m. wide, and weighs 3000 kg. The special body shown in the Figure is mounted on the chassis. There are low side-racks and the floor is 6 m. long and 2.25 m. wide; in front, a curved rack protects the roof over the driver, and at the back another rack limits the load to about 4 tons of hay or straw.

571 – **Safety Butteris for Paring Horses' Hoofs.** — AYME, H., in the *Journal d'Agriculture pratique*, Year LXXXIV, 1920, Vol. I, No. 9, pp. 172-173, 1 fig. Paris, Feb., 26, 1920.

This is a very useful little device and should replace the btuteris that has been used since time immemorial by farriers for paring horses' hoofs.

The very primitive tool now used has serious disadvantages and must be used most carefully or it is liable to wound either the horse or the man holding the horse's foot; it is difficult to sharpen, as the raised edges make it impossible to sharpen the inner part with the ordinary grindstone. Struck by these defects, M. ETIENNE, a farrier of Isle-sur-Sorgue (Vaucluse)

has invented a butteris which has the following advantages over the old type : The blade can be removed and can therefore be sharpened quite easily on any grindstone ; the front part of the tool is rounded so that there is no danger of wounding either the man holding the foot, or the horse being shod. The blade acts like a plane with the difference that the bevelled side is on top. The blade is held in a bronze frame and is fixed in place by a screw nut tightened up by a wing bolt ; as the screw stips in a groove, the blade can be adjusted to project more or less, and, in spite of wear, the cutting edge can always be kept in the right place.

ETIENNE Safety Butteris.

572 – **Review of Patents.** — *Sources :* CANADA U. S. A., FRANCE, BRITISH INDIA, NEW ZEALAND, UNITED KINGDOM, SWITZERLAND, see *R.*, January, 1920, No. 110.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada :* 195742 Cultivator ; 195820 Tractor cultivator ; 196241 Wheel hoe ; 196281 Spring-tine harrow ; 196355 Hoe ; 196590 Harrow ; 196804 Harrow and pulveriser.

France : 487045 Anchoring device for ploughing sets ; 499030 Centrifugal clod-breaker ; 499514 Motor plough.

United Kingdom : 134627 Disc harrow ; 135098 Machine for ploughing, harrowing and seeding.

United States : 1327828 Cultivator ; 1328896 Tillage machine ; 1329598 Cultivator with 2 rows of discs.

IRRIGATION, ETC. — *Canada :* 196202 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Canada :* 196587 Manure spreader ; 196790 Manure loader.

France :— 499293 Product for use as fertiliser or cattle food and method of preparation (cooking a mixture of blood and the stomach contents of cattle, then pressing and drying the product freed from superfluous liquid) ; 500150 Fertiliser containing dry, powdered ammonium nitrate, bone meal and other fertilising material.

New Zealand : 41177 Phosphorus-nitrogen fertiliser.

United Kingdom : 134665 Process for manufacturing potassium chloride.

United States : 1325957-1325958-1326163-1327654 Manure spreaders ; 1327353-1329597 Fertiliser distributors.

DRILLS AND SEEDING MACHINES. — *Canada:* 195972 Seeder; 196040-196041 Maize seeders.

United States: 1326613 Machine for cutting and planting potatoes; 1326711-1327971 Potato planters.

VARIOUS CULTURAL OPERATIONS. — *Canada:* 196077 Straw Spreader; 196241 Wheel hoe; 196355 Hoe; 196816 Weeding machines.

United States: 1325406; Cotton header; 1325566. Cotton thinner.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *British India:* 5030 Machine for gathering insects injurious to plants.

France: 484796 Chemical preparation for treating fungoid diseases of plants.

United States: Cotton header that can be used for capturing the boll-weevil; 1325475 Machine for gathering locusts.

REAPERS, MOWERS AND HARVESTING MACHINES. — *Canada:* 195847 Scythe; 196224 Shocking machine; 196459 Harvester; 196799 Mower transmission device: 196860 Lawn mower.

France: 499297 Locking device for binder connecting rods.

United States: 1326256 Mower; 1329220 Maize harvester; 1329632 Hand machine for gathering beans, etc.

MACHINES FOR LIFTING ROOT CROPS. — *United Kingdom:* 134965-135086 Potato lifters.

United States: 1326422 Beet lifter.

THRESHING AND WINNOWING MACHINES. — *Canada:* 195781 Haricot sorter; 196111 Flax ginner.

United States:— 1325219-1327193 Grain sorters; 1327297 Flax ginner; 1329752 Machine for removing the sheaths from maize cobs.

MACHINES AND IMPLEMENTS FOR THE STORAGE AND PREPARATION OF GRAIN, FODDER, ETC. — *Canada:* 195795 Method for preserving potatoes; 195835 Machine for carrying sheaves and shocks; 196398 Grain dryer; 196539 Tobacco leaf sorter.

Switzerland: 88561 Proof stick for hay.

United States: 1324799. Machine for cocking hay; 1324962-1325306 Hay press; 1327346 Hay cutter.

STEERING AND FRACTION OF AGRICULTURAL MACHINERY. — *Canada:* 196799 Transmission device for mower.

United States: 1326335 Wind engine; 1328808 Steering mechanism for tractors.

FEEDING AND HOUSING OF LIVESTOCK. — *Canada:* 196288 Stall for livestock.

France: 499293 Product for use as food for stock or as a fertiliser and method of preparation.

United Kingdom: 135107 Drinking trough.

United States:— 1325474 Bath for pigs; 1327088 Hog oiler; 1327346 Hay cutter; 1329516 Drinking trough; 1329939 Hygienic trough for pigs, not liable to freeze.

POULTRY KEEPING. — *United Kingdom:* 135436 Method of packing eggs.

FISHING. — *France :* 500201 Improved fishing balance.
BEE KEEPING. — *Canada :* 196016 Hive.
France : 500187 Multiple vertical honey extracter.
Switzerland : 84563 Hive.
INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *British India :* 5044 Apparatus for drying vegetable products.
DAIRYING. — *Canada :* 195871-196269 Separators.
New Zealand : 41164-42429 Milking machines.
United States : 1325179-1329451 Milking machines ; 1326376 Separators.
VARIOUS. — *Canada :* 196813 Machine for cutting hedges.

FARM BUILDING

573 – **Silo Construction.** — SHEDD. C. K. and FOSTER, W. A., in *Agricultural Experiment Station, Iowa State College of Agriculture and the Mechanic Arts, Bulletin* No. 189, pp. 94-148, 43 figs. Ames, Iowa, April 1919.

The construction of silos has been for many years one of the principal lines of investigation followed by the Agricultural Engineering Section of the Iowa Agricultural Experiment Station. Results have been published in the following bulletins : No. 100, July, 1908, revised and republished July, 1909 ; No. 117, June 1910, by J. B. DAVIDSON and M. L. KING and No. 141, June, 1913, by J. B. DAVIDSON. This new bulletin No. 189 is a revision of Bulletin No. 141 incorporating data of additional value obtained since 1913. No special type of silo is recommended. With reference to the water tank placed on top of a masonry silo, it has been found that treatment of the inner surface of the tank with a coating of asphalt followed by cement plastering apparently prevents leakage.

RURAL ECONOMICS

RURAL ECONOMICS

574 – **Results of Agricultural Book-keeping by Double Entry by the Pestalozzi Institution near Birr, Argovie, Switzerland, for the Year 1918-1919.** — ZAUGG, F., in *Annuaire agricole de la Suisse*, Year 20, Part 3, pp. 295-315. Lucerne, 1919.

GENERAL. — The Pestalozzi-du Neuhof Institution keeps the books of its farm on the double-entry system, which is controlled by the " Bureau de Comptabilité Agricole du Secrétariat des Paysans Suisses. From the results obtained in 1918-19, compared with those of previous years, which are dealt with in the present report, an opinion can be formed as to the utility of agricultural book-keeping by double entry and the inexhaustible mine of information and suggestions which it provides. The accounts are kept by the Agricultural Accounting Bureau of the Secretariat, using as a basis, weekly and monthly reports sent by the Director of Neuhof to the Secretariat which, for its part, keeps and closes the accounts.

RESULTS. — A) *Fundamental Accounts* : (1) *Capital.* — The farm capital of Neuhof has changed little since 1916, when stock was taken :

(1) *Cf.* Results of farm accounts kept by double entry, in *Annuaire agricole de la Suis*, Pt. 1, 1918, pp. 41-118. Berne, 1918.

TABLE I. — *Composition of the capital of Neuhof farm.*

Capital	On May 14, 1916		On April 30, 1917	
	Total value fr.	Per hectare fr.	Total value fr.	Per hectare fr.
Capital in land	62 770.00	1 706.47	62 770.00	1 7064.7
Improvements	—	—	—	—
Buildings	49 400.00	1 343.00	51 100.00	1 89 21
Fruit trees	5 000.00	135.93	5 000.00	1 359.33
Forests	3 500.00	95.15	3 614.00	98.25
Advances to crops	10 737.98	291.90	16 729.34	454.82
Total estate capital	**131 407.98**	**3 572.45**	**139 213.34**	**3 784.68**
Livestock	33 747.25	917.45	31 806.00	864.68
Deadstock	13 162.05	357.82	14 540.00	395.28
Floating capital	5 558.75	151.13	10 351.24	281.41
Total farm capital	**52 468.05**	**1 426.40**	**56 697.24**	**1 541.37**
Total active capital	**183 876.03**	**4 998.85**	**195 910.58**	**5 326,05**
Mortgage debts	—	—	—	—
Current depts.	—	—	952.20	25.90
Total passive capital	—	—	952.20	25.90
Net Farm capital	**183 876.03**	**4 998.85**	**194 958.38**	**5 300.15**

TABLE II.

Capital	Neuhof		Average of 50 farms	
	Fr. per hectare	%	Fr. per hectare	%
Land	1 706.47	34.14	1 515.15	38.96
Improvements	—	—	15.17	0,39
Buildings	1 343.00	26.87	1 082.70	27.84
Fruit trees	135.93	2.72	138.84	3.57
Vines	—	—	16.72	0.43
Forests	95.15	1.90	208.45	5.36
Advances to crops	291.90	5.84	2.72	0.07
Estate capital	**3 572.45**	**71.47**	**2 979.75**	**76.62**
Livestock	917.45	183.5	533.96	13.73
Dead stock	357.82	71.6	180.06	4.63
Floating capital	151.13	30.2	195.23	5.02
Fram capital	**1 426.40**	**28.53**	**909.25**	**23.38**
Total active capital	**4 998.85**	**100.00**	**3 889.00**	**100.00**

the beginning of the year for the first time. Certain difficulties were met with at the time, since certain groups of capital had to be estimated in the absence of data that could serve as a basis, as, for example, the heading, *advances to crops*. These difficulties, however, disappeared in the following years and each element of capital found its own place in the balance sheet. Table I shows the composition of the capital of the Neuhof farm, and will help to explain the data relating to the year 1918-19, compared with previous years. In Table II, the capital invested in the Neuhof farm is compared with the average of other farms of the same area which are included in the researches of the " Sécrétariat des Paysans Suisses " on agricultural profit. Neuhof has an area of 36.7[illegible] hectares and thus belongs to the category of large farms (over 30 hectares).

The average active capital, on the average, of the 50 farms that constituted this group in the researches of the Secretariat was 3 889 fr. per hectare, or about 1 000 fr. less than in the case of Neuhof. The Neuhof estate cost more than the average set down as the inventory value of farms of the same area which send their accounts to the Secretariat. However the percentage ratio of the different groups to the total active capital is more favourable in the case of Neuhof than in the case of the group with wich it is compared in Table II, owing to the fact that less active capital is engaged in the estate than in the working capital. The profit yielded by the farm seems as if there is no reason that it should be unfavourably influenced by the extent of the capital invested per hectare.

It has already been stated that little change has taken place in the Neuhof estate capital since 1916, and, in addition, there have been no important changes in the capital invested in building.

The *advances to crops*, however, which amounted to 10 738 fr. in the spring of 1916, increased to 28 146 fr. in the spring of 1919. This heavy increase is primarily due to the extension of arable land. The constant intensification of exploitation also plays a part and the increased cost of fertilisers, seeds, and labour are contributory factors.

The farm capital reflects the high prices of livestock, and from 33 747.[illegible] fr. (including the horses, pigs, and poultry) on May 1, 1916, increased to 38 404 fr. in the spring of 1919, in spite of the reduction in the number of livestock that had to be brought about in 1916. As regards this, the producing cows were not valued at current market prices, but on the basis of an average value, corresponding to that conferred upon them by their ultimate destination.

(2) *Movement of cash.* — The total receipts and expenses were as follows:

Years	Total receipts Fr.	Total expenses Fr.
1916–1917	39 749.50	39 093.50
1917–1918	45 699.40	33 160.48
1918–1919	59 583.25	37 472.04

The distribution of the receipts was as follows:

Receipts from	1916-1917 Fr.	1917-1918 Fr.	1918-1919 Fr.
ivestock	25 686.80	26 991.10	37 822.65
rops	13 076.20	16 899.50	20 718.55
arious	986.50	1 808.80	1 042.05

The receipts of Neuhof in 1919 were considerably increased by the rops. The receipts from potatoes alone were 15 240.50 fr. in 1918-1919, gainst 7 271.80 fr. in 1916-1917.

A large part of the expenses is due to the purchase of fodder and other ood as is shown below:

	1916-1917 Fr.	1917-1918 Fr.	1918-1919 Fr.
oncentrated food	10 275.60	5 326.48	4 591.13
ermented hay or hay still standing	8 555.35	6 089.45	8 135.18
ost of summering	871.00	—	—

Renting land from the ANGLIKER Foundation had the effect of distinctly mproving, in the last few seasons, the production of the hay required for fairly large herd.

B) Distribution of expenses: (1) *Household expenses.* — The household xpenses, due to food for those living at Neuhof were as follows:

Years	Total Fr.	At the rate of 1 day's food per man Fr.
916–1917	24 516.84	2.05
917–1918	32 135.71	2.69
918–1919	39 645.18	2.98 (aproximately)

According to the researches of the "Secrétariat des paysans," as egards numerous farms under its control, the household expenses were as follows:

Years	Number of farms	Francs
1916	295	1.93
1917	347	2.35
1918	400	2.85

(2) *Labour costs.* — These were distributed in the following way:

Items	1916–1917 Fr.	1917–1918 Fr.	1918–1919 Fr.
Wages in cash	4 926.60	3 886.05	4 412.01
Maintenance	3 117.50	3 467.00	3 923.54
Payment in kind	—	—	64.00
Rent of biuldings and instruments	200.00	190.00	220.00
Director	1 200.00	1 200.00	1 200.00
Pupils	1 150.00	3 091.50	3 074.10
Various	83.20	424.09	227.65
Total cost of tabour	**10 677.30**	**12 258.64**	**13 121.30**
Labour cost per hectare	286.28	276.20	291.91
Cost of labour per working hour	06.46	0.659	0.87

The distribution of the labour between some of the chief branches of the farm is shown below:

Years	Crops		Fodder crops		Livestock	
	Hours	% of hours worked	Hours	% of hours worked	Hours	% of hours worked
1916–1917	3 860	15.86	1 820	7.48	9 720	39.94
1917–1918	4 851	19.42	2 121	8.49	9 410	37.67
1918–1919	2 704	12.65	3 490	16.33	9 238	43.25

The increase in the hours worked in fodder crops is due to their extension, whereas the decrease in the hours worked in crops is largely due to good weather, owing to which the work was done quickly.

(3) *New distributions, purchase and amortisation of buildings, instruments, and machinery.* — The rent of buildings is made up of the following items:

	1916-1917 Fr.	1917-1919 Fr.	1918-1919 Fr.
Current repairs	641.01	896.76	1 578.45
Amortisation	500.00	500.00	500.00
Interest	1 976.00	2 044.00	2 024.00
Taxes	190.75	148.67	136.24
Total rent of buildings	**3 307.76**	**3 589.43**	**4 238.69**
Per 100 fr. of capital in buildings	**6.70**	**7.02**	**8.38**

The capital distribution per 100 fr. of deadstock is as follows :

	1916–1917 Fr.	1917–1918 Fr.	1918–1919 Fr.
Current distribution	10.46	17.01	26.24
Amortisation	10.55	12.02	15.36
Interest	4.50	4.50	4.50
Fire insurance	0.05	0.11	0.23
Taxes	0.39	0.29	0.27
Rent of buildings	4.25	4.17	5.21
Total : rent of deadstock	**30.20**	**38.10**	**51.81**

The increased expenses due to deadstock in the last season is accounted for by high labour costs and costly material.

(4) *Use of concentrates.* — The control of the movement of the natural products can be used to find the exact use of the concentrated foods. The consumption of feeding stuffs is expressed in kg. of *starch value* and in francs in the appended table :

	1916–1917	1917–1918	1918–1919
	kg starch value	kg starch value	kg starch value
Foods bought	24 969	11 785	5 273
Foods produced	10 460	12 256	16 919
Total food consumed	35 429	24 041	22 192
	fr.	fr.	fr.
Foods bought	10 545	6 946	6 169
Foods produced	8 803	11 275	19 514
Total food consumed	19 348	18 221	25 683

The prices entered per 100 kg. of starch value rose from 54.61 fr. for the total consumption in 1916-17, to 75.80 fr. in 1917-18, and 115.20 fr. in 1918-19, so that food per day per 1 000 kg. live weight increased from 2.57 fr. in 1916-17 to 3.55 fr. in 1918-19, whilst the quantity of starch value fed, fell from 4.68 kg. per 1 000 kg. live weight in 1916-17 to 3.08 kg. in 1918-19. The bought foods rose in price by 160 % and those produced by 37 %. The quantity of concentrated food distributed, expressed in absolute figures, has decreased by 37 % since 1916.

The number of normal days of maintenance was 7 555 in 1916 and only 7 225 in 1918. The consequences of decreasing the starch value given as concentrated foods in 1918 (3.08 kg. per normal day, against 4.68 kg. in 1916) are shown in the production of milk, meat, and manure.

(5) *Purchases of standing hay and aftermath and of fermented hay.* —

Expressed in starch values, the purchases of these foods were 29 727 kg. in 1916-17, 14 944 kg. in 1917-18, and 16 295 kg. in 1918-19. The cost of production increased from 12.32 fr. and 11.53 fr. in 1916-17 to 21.83 fr. and 23.67 fr. in 1918-19, respectively for dry fodder bought as standing hay and aftermath, and for fermented hay.

(6) *Purchases of fertilisers.* — The quantities of fertilisers used were as follows :

	1916-1917	1917-1918	1918-1919
Basic slag	7 325 kg.	4 740 kg.	100 kg.
Superphosphates (18 %)	550	—	—
Potash salts (30 %)	2 750	5 600	2 850
Nitrate of lime	1 650	2 080	1 000
Lime	—	100	6 300
Total costs	**1 959,20** fr.	**2 348,66** fr.	**1 105,52** fr.

The quantities bought, decreased owing to difficulties in obtaining supplies of fertilisers.

C) Yield accounts : Winter wheat. — The area under winter wheat more than doubled during the three years. The chief results regarding this crop are given in Table III. The 1916 crop was very poor,

TABLE III. — *Wheat.*

		1916-17	1917-18	1918-19
Area cultivated	ares	**390**	**451.4**	**825.39**
Crop, total grain	kg.	4 150	7 360	16 400
Crop, grain per hectare	»	1 064	1 630	1 987
Crop, total straw	»	17 740	17 500	51 700
Crop, straw per hectare	»	4 549	3 877	6 263
Total crop in starch values	»	5 514	7 823	19 301
» » » » » per hectare	»	1 414	1 733	2 338
Cost of producing 100 kg.:				
Seed wheat	fr.	48.06	41.35	36.43
Wheat	»	41.59	37.28	32.84
Straw	»	8.32	5.24	6.16
Market price per 100 kg.:				
Seed wheat	»	61.00	71.00	71.00
Wheat	»	—	64.00	64.00
Straw	»	9.00	9.00	12.00
Total net yield	»	1 278.08	3 479.42	9 388.96
Net yield per hectare	»	327.70	770.80	1 137.60
Net yield per 100 fr. of capital	»	7.12	19.78	25.71

that of 1917 below the average and that of 1918 satisfactory (about 20 quintals per hectare). The last of the years under review had the lowest costs of production, with about 34.50 fr. per quintal. The sale price varied between 64 and 71 fr., so that a good profit per quintal was made. The interest on the capital invested in the wheat crop was 25.7 %, against 7.1 % and 19.8 % for the two previous years.

The author remarks that the decline in wheat growing that took place before the war was largely due to the excessively low price of this cereals, which was selling at 18 to 20 fr. per quintal, whereas the cost of production varied between 34 to 35 fr. per quintal.

(2) *Oats.* — The cost of production for oats in 1918 was 36.65 fr. per quintal, and 40.20 fr. for seed oats, for 20.25 quintals per hectare, compared with 17.72 and 21.94 fr. in 1916 with a production of 19.27 quintals per hectare.

The cost of manuring was very high and overloaded the oat account ; the other items were also very high. The interest on the capital invested in the oat crop was 21.7 % in 1918, against 23.38 % in 1916.

(3) *Spring barley.* — The production cost of spring barley was 45.38 fr. in 1918, for 21.22 quintals per hectare, against 22.68 fr.in 1916, with a yield of 14.34 quintals per hectare.

TABLE IV. — *Potatoes.*

		1916-1917	1917-1918	1918-1919
Area cultivated	ares	**621**	**707.39**	**489.61**
Crop :				
Potatoes for planting	kg.	15 000	11 457	26 180
Potatoes for food	»	41 593	113 673	51 370
Potatoes for livestock	»	5 410	15 970	27 320
Potatoes total	»	62 003	141 100	104 870
Potatoes per hectare	»	9 966	19 950	21 417
Total crop in starch value	»	13 951	32 320	23 595
» » » » per hectare	»	2 247	4 569	4 819
Production cost per 100 kg. :				
Potatoes for planting	fr	14.23	9.97	11.10
Potatoes for food	»	12 80	8.03	7.77
Potatoes for livestock	»	5.69	5.26	7.03
Market price per 100 kg. :				
Potatoes for food	fr.	28.00	20.00	30.00
Potatoes for planting	»	15.00	15.00	81.00
Potatoes for livestock	»	8.00	10.00	19.00
Total net yield	»	4 366.16	8 964.54	17 920.83
Net yield per hectare	»	703.00	1 267.00	3 661.00
Net yield per 100 fr. of capital	»	23.88	34.90	81.02

It may be said that, in 1918, cereal crops gave from medium to good yields of grain and straw, but the production costs had heavily increased and a sa-

tisfactory profit was only made owing to the high prices guaranteed for that season (for wheat 74 and 71 fr., for oats 62 and 68 fr., for seed and market wheat and oats respectively ; for barley 60 fr.).

(4) *Potatoes.* — The data for this crop are shown in Table IV. The 1918 potato crop in Switzerland was generally better than had been expected. The same happened at Neuhof, where the results were the best of the three years, and, in addition, the sale prices were good. The production costs which, from an absolute standpoint, had increased, did not reach the figures of previous years when compared with the quantity harvested.

The capital invested in the potato crop yielded an interest of 81 % and the net yield per hectare was 3 661 fr., as against 703 fr. in 1916 and 1 267 fr. in 1917. These figures show the nature of the result given by the potato crop in 1918, a result which has helped the profit from the whole farm.

The crop gathered on the land rented from the ANGLIKER foundation was 20 540 kg. The total crop, including the small store of 1 200 kg. from the beginning of the season was utilised as follows :

Sale	67 760 kg	53,53 %
Household	14 000 »	11,06 »
Livestock	27 310 »	21,58 »
Seed tubers	17 530 »	13,83 »
Total	**126 610** kg	**100,00** %

It should be added that the many persons always available at Neuhof, constitute a very important factor as regards the extension of potato growing. In this respect Neuhof is more advantageously placed than the so called peasant farm.

(5) *Artificial meadows.* — These constitute a branch of the farm to which more attention will probably be paid at Neuhof in the future, when cultivation again will have to give way to some extent to intensive livestock production. The artificial meadows at Neuhof have covered the following areas :

416,00	ares	in	1916-1917
370,25	»	»	1917-1918
336,84	»	»	1918-1919

The profit from the forage grown is not calculated separately because it is included under livestock in the net profit account. However, the production costs have been ascertained, extended to the meadow and per 100 kg., are as follows :

	1916–1917 Fr.	1917–1918 Fr.	1918–1919 Fr.
Hay	9.84	—	6.17
Green fodder	1.97	1.26	1.42
Pasture	1.77	—	1.42

The production costs are lower than those usually accepted.

(6) *Natural meadows.* — The area occupied by natural meadows at Neuhof, of which they still form too large a part, was as follows :

In 1916-1917, from	1255,00	ares	or	37,6 %	of the	total	area	(except	forestes)	
In 1917-1918, »	1205,38	»	»	36,1 »	»	»	»	»	»	»
In 1918-1919, »	1145,98	»	»	34,3 »	»	»	»	»	»	»

The yields obtained from these areas are given below :

	1916–1917	1917–1918	1918–1919
Hay	15 680 kg.	28 735 kg.	22 285 kg.
Aftermath	—	2 550	5 330
Green fodder	163 650	115 985	219 755
Pasture	49 570	36 900	26 100
Total crop in starch values	26 026	30 472	42 303
» » » » » per hectare.	2 074	2 528	3 692

The artificial meadows show a considerable superiority over the natural meadows. The quantities of starch value produced per hectare of area were as follows :

	Artificial meadows	Natural meadows
1917–1918	3 714 kg.	2 528 kg.
1918–1919	5 681	3 692

Extended to the meadow, the production costs per 100 kg. were :

	1916-1917 Fr.	1917-1918 Fr.	1918-1919 Fr.
Itay	9.72	7.44	8.08
Aftermath	—	8.37	8.70
Green fodder	1.78	2.33	1.86
Pasture	1.49	2.01	1.85

The *dry fodder account,* which includes all the costs of the forage crop accounts, unites the costs relating to the natural and artificial meadows, as well as the purchases of fermented and standing hay. The costs are given below :

	1916-1917 Fr.	1917-1918 Fr.	1918-1919 Fr.
100 kg. of starch value without deducting the manurial value of the fodder	27.57	24.28	40.41
100 kg. of starch value after deducting the manurial value of the fodder	25.01	23.05	39.19
100 kg. of starch value of fermented hay	12.87	11.88	16.63

These figures show that, particularly, in 1918-19, the cost of dry fodder was very high, owing to the high price of bought fodder.

By means of special researches, the *total work* devoted to hay-making and to the aftermaths was determined. The work thus utilised, calculated per quintal of dry fodder is given below :

	1916–1917		1917-1918		1918–1919	
	Hay-making	Aftermath	Hay-making	Aftermath	Hay-making	Aftermath
Hours worked by the men.	1.06	0.72	1.23	0.45	0.96	0.28
Hours worked by the teams	0.79	0.95	0.98	0.30	0.54	0.23

(7) *Fruit-growing.* — Fruit-growing is not important at Neuhof, but all the same it gave very satisfactory results during the last two years. The net yield was :

	Total (fr.)	As % invested capital (fr.)
1916–1917	178.58	2.75
1917–1918	2 391.40	38.55
1918–1919	1 284.18	24.88

The production costs and market prices were as follows :

	1916-1917 Fr.	1917-1918 Fr.	1918-1919 Fr.
Production costs :			
Fruit for the household	35.06	5.16	13.29
Fruit for cider-making	19.28	2.58	7.59
Market prices :			
Fruit for the household	20.00	20.00	35.00
Fruit for cider-making	11.00	10.00	20.00

(8) *Forest crops.* — These occupy an area of 325 ares. The stand, partly made up of broad-leaved trees, is below the average. The profitable sale of a few high trees and of thinned-out wood gave a positive result in 1917-1918, but during the other 2 years, the expenses were not covered by the growth.

(9) *Draught horses.* — The appended statement shows the hours of work performed by the horses.

	1916-1917	1917-1918	1918-1919
Total	9 179	11 283	11 946
Per hectare	250	254	269
Per day fed.	7	8	8

The costs per hour worked by the horses were :

in 1916-1917	0.65 fr
in 1917-1918	0.74 fr
in 1918-1919	0.81 fr

Taking the duration of the work as 10 hours, the cost of a driver with a team of 2 horses was :

in 1916-1917	19.52 fr
in 1917-1918	21.32 fr
in 1918-1919	24.80 fr

The increased expense is mainly due to the heavier cost of feeding.

(10) *Draught oxen.* — The cost per hour worked by oxen was :

in 1916-1917,	0.469 fr
in 1917-1918,	0.255 fr
in 1918-1919,	0.372 fr

The oxen were not worked so intensively as the horses. During the 3 years, they yelded 91,44, and 30 hours of work per hectare and 3 1, and 1.7 hours of work for each days food.

(11) *Milking cattle.* — The number of cows was as follows :

in 1916-1917	17.9 head
in 1917-1918	15.1 head
in 1918-1919	16.6 head

The total cost of the dairy cattle was as follows :

in 1916-1917, :—	3,23	fr.	per day	per aw	and	1179	fr	per annum.
in 1917-1918, :—	3,56	»	»	»	»	1300	»	» »
in 1918-1919, :—	5,38	»	»	»	»	1965	»	» »

The cost of feeding alone amounted :

in 1916-1917, to	2,19	fr.	i. e,	67.69 %	of	the	total cost
in 1917-1918, to	2,13	»	»	59.52 %	»	»	» »
in 1918-1919, to	3,59	»	»	66.77 %	»	»	» »

The money value of the milk produced, the calves, manure, growth, and work is given below.

	Per day's food (fr.)	Per cow per annum (fr.)
1916–1917	2.66	9 71
1917–1918	2.13	7 77
1918–1919	4.1[illegible]	15 11

The total yield from the dairy cattle was thus inferior to the expenses and the deficit per cow per year was 208 fr. in 1916-17, 523 fr. in 1917-18, and 454 fr. in 1918-19, with the following production which, being above the average, can be considered as sufficient :

Production	1916–1917	1917-1918	1918-1919
	litres	litres	litres
Total milk	54 646.4	46 363.4	47 071.6
Per cow per day	8.38	8.39	7.75
Per cow per year	3 059	3 063	2 829
Per 100 kg. of starch value	114.4	111.7	103.7

The milk was partly sold (6 429.6 litres in 1918) and partly consumed by the household (10 921 litres in 1918), partly separated for butter-making (14 540 litres in 1918), partly fed to calves (15 141 litres in 1918), and partly fed to pigs (40 litres in 1918).

The separated milk yielded :

in 1916-1917,	873.14 kg. of butter, or	4.12 kg.	per 100 litres of milk
in 1917-1918,	488.32 » » »	3.89 »	» » » »
in 1918-1919,	606.11 » » »	4.17 »	» » » »

Assuming a price of 10 centimes for skim milk in 1916 and 1917, and 14 centimes in 1918, butter making increased the value of the milk to 25.94 centimes in 1916-17, 32.77 centimes in 1917-18, and 43.84 centimes in 1918-19. As the price of milk was 21, 26.7, and 32.5 centimes during the 3 years, and that of butter 4.35, 5.95, and 7.50 fr., butter making results appear more profitable than milk selling, assuming the milk to cost 25.52, 30.32, and 42.26 centimes at the shippon, for the 3 years under survey.

The cost of production is thus considerably above the sale price of the milk, but less than the yield from butter making.

Allowing for the cost of feeding and for the capital it represents, the capital invested in the exploitation of dairy cattle amounts, in round figures,

to 55 000 fr., or about 25 % of the total capital. This capital gave the following net yield :

	Total	%
1916-1917	275.43 fr	0.51
1917-1918	1 480.90 »	2.96
1918-1919	3.11 »	0.005

The chief cause of these unfavourable results is the increase in the cost of feeding and the decline in milk production.

(12) *Young stock.* — This account includes all the cattle from birth to the moment when they become cows, bulls, or draft oxen. The profit from some 14 head during the 3 years was, 1.11, 9.86, and 35. 0% respectively, Again the gain of 1 kg. in weight cost 2.33, 3.18 and 3.69 fr., respectively, for the 3 years. The increase in weight during the 3 years is given in the appended statement :

	1916-1917	1917-1918	1918-1919
Total gain . . . . . kg	3 374	2 637	3 371
Gain per day per head . . . . . »	0.63	0.51	0.67
Gain per 100 kg. starch value . . . . . »	23.6	13.0	23.2
Value of the gain . . . as a total . . fr.	7 442	9 517	11 699
Value of the gain . . . per kg. . . . »	2.25	3.61	3.47

(13) *Pigs.* — The yields from pigs consist of increase in weight, manure, and eventual profit from the use of the boar. The increase in weight during the 3 years is given below :

	1916-1917	1917-1918	1918-1919
Total . . . . . kg	3 816	3 304	1 759
Per day per head . . . . . »	0.233	0.193	0.128
Per 100 kg. starch value . . . . . »	15.1	18.9	15.3

It should be observed that, during the last 2 years, Neuhof has mainly gone in for rearing, not fattening, so that the increase in weight is very small. During the 3 years, the value of the gain in weight was 2.70, 5.92, and 8.54 fr., respectively, and the corresponding expenses 3.09, 3.63 and 6.97 fr. The profit per 100 fr. of capital invested was 12.10 fr. in 1916, 59.72 fr. in 1917 and 22.93 fr. in 1918.

(14) *Poultry.* — At Neuhof there are 30 fowls, on an average, to provide the household with eggs, which are only sold on exceptional occasions. The egg production was 90, 72, and 42 eggs per fowl per year for the three seasons. The results for 1918 were very moderate.

A few figures relating to the profit are appended :

	1916-1917	1917-1918	1918-1919
Cost of production . . . . . per egg	19 centimes	16 centimes	33 centimes
Market price. . . . . » »	20 »	30 »	36 »
Profit . . . . . » »	1 »	14 »	3 »
Net yield per 100 fr. of capital.	9.16 %	26.50 %	16.89 %

(II) *Final account.* — In this account are found the income, profit net yield, etc., for the whole farm. The net yield as a percentage of the, capital invested is given in Table V and is the only item that we quote.

TABLE V. — *Net yield of Neuhof as a percentage of the capital invested.*

	1916 1917	1917-1918	1918-1919
Winter rye	—	0.88 %	—
Winter wheat	7.12 %	19.78	25.74 %
Winter barley	7.53	—	—
Spring barley	17.76	27.63	11.90
Oats	23.38	16.69	21.70
Total for cereals:	**16.05 %**	**18.40 %**	**18.91 %**
Potatoes	23.88	34.90	81.02
Beets	19.90	21.41	65.05
Total field crops	**18.12 %**	**24.67 %**	**41.61 %**
Horses	3.90	7.96	6.33
Oxen	3.50	4.84	7.43
Dairy cattle	0.51	2.96	0.05
Young stock	0.11	9.86	3.05
Pigs	— 12.10	— 59.72	22.93
Poultry	9.16	26.50	16.89
Total for livestock:	**0.08 %**	**12.33 %**	**4.87 %**
Fruit crops	2.75	38.55	24.78
Forest crops	— 1.96	16.51	— 4.40
Total net yield:	**6.35 %**	**17.69 %**	**19.78 %**
Expressed in money, the net yield is :			
For the field crops . . . . . .fr.	12 441.10	17 277.15	35 545.98
For the livestock . . . . . »	88.29	14 023.23	5 470.56
For the fruit crops. . . . . »	178.58	2 391.23	1 284.18
For the forest crops. . . . . »	— 68.55	768.54	— 222.39

Table V clearly shows the growing superiority of field crops, which are favoured at Neuhof by the work of the pupils. For details regarding

this work and its valuation, a report by the author (Part. 1 of the *Annuaire Agricole de la Suisse*, 1918, pp. 41-114) may be consulted.

Only in 1917-1918 did the livestock give an appreciable return.

The *conclusion* arrived at is that, at Neuhof, no restriction can be placed on field crops for the moment, as they ensure the revenue of the undertaking, whilst conserving the exploitation of livestock as far as possible. In time, the area occupied by natural meadows will be reduced to the proportion strictly necessary, and the artificial meadows and field crops will benefit from the largest possible area.

575 - **Cost Accounts on a Fruit Farm in Scotland.** — James Wyllie (*West of Scotland Agricultural College*) in *The Scottish Journal of Agriculture*, vol. I, nº 23, p. 301-306. Edinburgh, July 1918.

Arrangements were made in 1914 by the West of Scotland Agricultural College to keep a detailed record of costs on a fruit farm at Nemphaar, near Lanark, with a view of obtaining data as to the relative efficiency of various fruit farming rotations. This work is still in progress, but in view of the paucity of systematic accounts of this kind, the author has thought it useful to publish the first results :

Blank forms were distributed for : — *a*) manual labour, *b*) horse labour, *c*) general expenditure, *d*) receipts.

Duly completed they were sent back to the College, where the tabulation of results and preparation of accounts were done under the direction of the author.

By this means, records were kept for the following : strawberries, gooseberries, raspberries, and black currants. The last two crops were not handled to any large extent ; the data contained in this report refer then to the two first.

Example of cost account. — In the first place, the author gives as an example in Table I, the completed cost account to indicate the method pursued.

No charge is indicated concerning the cost of management. The omission is justified by the fact that the net profit shown may be considered as the farmer's " labour income."

Cost of planting strawberries in 3 successive seasons. — The data obtained with regard to this subject is summarised in Table II.

The low cost of planting in 1916. was due to :

1) the cost of the plants which was only 2s 6d. per 1 000 compared with 5/- and 7/- in 1915 and 1917 respectively ;

2) to the smaller expenditure on hoeing and weeding.

Cost of production and returns. — *Strawberries.* — Table III gives the average cost of production, yield, value of crop and net profit per acre, and the average sale price per lb. and per cent. for each of the three years.

It is necessary to state that in 1915, there were five fields involved (three under 1st crop, one under 2nd and one under 3rd), in 1916 also five

(one under 1st crop, three under 2nd and one under 3rd), and in 1917, only three fields (one under 2nd crop, and two under 3rd).

This partly explains why the cost per acre in 1917 had increased so little compared with 1915 ; in 1915 the total cost of £ 45 per acre had been divided as follows ; £ 20 for crop I, £ 15 for crop II, and £ 10 for crop III.

The most noticeable feature in Table III is the extraordinary fluctuations in yield. Independantly of the variety cultivated, and whether first, second, or third crop, the predominating factor seemed to have been the weather.

This table indicates also that the existing methods by which the fruit reaches the consumer are far from being economical.

TABLE I. — *Cost account.*

Field. — No. 3 (b).
Acreage. — 2 acres 1 rod 9 poles. 20 yds.
Strawberries. — Second crop.
Varieues. — Ruskin. Lord Overtown. Bedford Champion.

Dr.				Cr.		
1917	No. of hours	Total cost	Cost per acre	1917	Total Return	Return per acre
		£ s. d.	£ s. d.		£ s. d.	£ s. d.
To valuation . . .	—	—	25 0 0	By 6452 lbs strawberries	159 10 2	69 1 1
» winter digging (P)	106	3 1 9	—	(i e. 2793lbs per acre at 5.93 d per lb.)		
» weeding, hoeing .	1155	16 10 0	—			
» harvesting and marketing . . .	1399	25 12 6	—	By valutation carried forward	—	10 0 0
» horse labour at 6 d per hour	33	0 16 6	—			
» chips and punnets	—	9 0 0	—			
» carriages	—	2 12 6	—			
» brokerage	—	8 3 5	—			
	2693	£ 65 16 8	28 10 0			
» rent, rates and taxes	—	—	2 12 0			
» general expenses .	—	—	0 15 0			
» interest on capital	—	—	0 10 0			
» net profit	—	—	21 14 1			
			£ 79 11		—	£ 79 11
To valuation brt forward			£ 10 0 0			

P = Piecework

LABOUR REQUIREMENTS OF STRAWBERRIES. — Accurate records have been kept of the time spent (man and horse hours) on each field, and from these the following table has been constructed.

TABLE II. — *Cost of planting strawberries*

Year	Field	Acreage				Cost per acre		
		Ac.	ro.	po.	yds.	£	s	d
1915	3 (b)	2	1	9	20	44	7	3
1916	1 (b)	2	0	0	0	31	15	4
1917	10 (a)	1	1	25	0	63	15	7

TABLE III. — *Cost of Production and Returns - Strawberries*

Year	Acreage				Average cost of production per acre			Average yield per acre	Average Sale Price		Average value of crop per acre			Average net profit per acre		
									Per lbs	Per cwt						
	Ac.	ro	po	yds	£.	s.	d.	lbs	d.	s. d.	£.	s.	d.	£.	s.	d.
1915.	7	1	23	14	38	2	9	5063	3.27	30 6	68	19	9	30.	17.	0
1916.	7	0	33	4	36	8	2	2166	3.67	34 3	33	2	1	3.	6.	1 (loss)
1917.	3	3	39	4	41	1	8	3739	5.62	52 6	87	10	8	44.	9.	0

TABLE IV.

Year	Hours. Man Labour		Hours. Horse Labour	
	Per acre	Per cwt.	Per acre	Per cwt.
1915	1134	25	21	.5
1916	1017	53	18	1.
1917	956	29	17	.5

The cost of manual labour, apart from the labour of planting, constituted about 43 % of the total cost of production. The average cost per hour being 3.4*d* per hour in 1915. 3.6*d* per hour in 1916, and 4.3*d* per hour in 1917.

The varietes grown were Ruskin, Lord Overtown, and Bedford Champion.

Gooseberries. — A single field extending to nearly 4 ½ acres was cultivated with gooseberries, variety "Whinham's Industry." The relative data in connection with the crop are shown in Table V.

The variations in yield are more noticeable than those associated with strawberry growing.

Whilst 1915 and 1916 showed handsome profits, they were lowered in 1917. As regards labour requirements, it requires about the same amount as strawberries, but in 1916 the proportion rose however to 5.1 % of the total cost of production.

These first results in the culture of small fruits on agricultural holdings on a industrial base, are certainly not sufficient to draw conclusions from.

The different elements of risk seem so considerable that they necessitate investigation as to the total yearly profit a loss over a period of years, in order to make it feasible to establish exact averages.

Furthermore, research work should be extended over a wide area in order to eliminate the effect of local conditions as much as possible.

TABLE V. — *Cost of Production and Returns* - Gooseberries.

Year	Average cost of production per acre	Average yeld per acre	Average sale price per cwt	Average value of crop per acre	Average net profit per acre	Man hours		Horse hours	
						per acre	per cwt	per acre	per cwt
	£. s. d.	cwts	s. d.	£. s. d.	£. s. d.				
1915	18.13.7	47.4	24 0	59 6 7 *	40 13 0	679	14	26	6
1916	38.11.6	74.7	20 0	75 13 10	37 2 4	1093	15	46	6
1917	11. 6.5	74	40 0	14 14 8	3 8 3	136	18	3	2

* Includes £ 15 for potatoes interplanted amongs young bushes.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

576 – **The Production of Alcoholic Fermentation by Adding Pure Yeasts.** — CAUDA, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. III Pt. 10-12, pp. 524-535. Modena, 1919.

The author has carried out several fermentation experiments with juice from Malaga raisins or from sterilised Nebbiolo di Barbaresco grapes. Except control samples which were fermented naturally without any addition, selected Barbera and Canaiolo ferments were added to the must, as well as some nutrient substance, such as monopotassium phosphate (0.05 gm. %), or ammonium carbonate (0.2 gm. %), asparagin (0.2 gm. %), or peptone (0.2 gm. %). Fermentation developed rapidly in the musts to which nitrogen had been added in the following order : — first to the must treated with ammonium carbonate, then to that containing asparagin, and finally to that containing peptone. Fermentation lasted much longer (over 105 days) in the control must to which nothing had been added and in that which contained phosphate. The phosphate also assisted the growth of the ferment, but the nitrogenous compounds, especially ammonium carbonate and asparagin, were more efficacious. It seemed as if the musts aged more rapidly owing to the addition of nitrogenous compounds ; in fact they had a yellowish colour (especially, those containing peptone), which shows rapid ageing. The author has arrived at the conclusion that the use of asparagin in wine making is advisable, particularly as it presents advantages from the economic point of view.

577 – **The Relationship of the Chief Acids in Wine.** – GARINO-CANINA, D. E. (R. Stazione, enologica sperimentale di Asti), in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Pt. 10-12, pp. 536-541. Modena, 1919.

In a previous paper (Studio sulla variazione degli acidi nel succo d'uva durante il processo di maturazione, *Annali della R. Accademia d'Agricol-*

tura di Torino, vol. LVII, 1915), the author has shown that, given the tartaric acid content of the wine expressed in cc. of normal solution per litre, a relation can be established between the total free and the combined acidity (by the alkalinity of the ash) also expressed in cc. of normal solution ; in this way a constant can be obtained for each wine-growing district and for each year of wine production. Once ascertained, this constant can be used to detect watering with the addition of cream of tartar and tartaric acid. The author stated that " A ratio of this kind, founded on the physiology of the ripening of the grape, like those proposed by GAUTIER and others, and conjointly with them, would be of great assistance to the chemical expert. If old or simply mature wines are in question, the malic acid that has disappeared will have to be calculated, and correction made for this and for other factors made necessary by the alterations and treatments.

The present paper is a corollary of the former, and attempts to show the actual percentage content of tartaric acid compared with the other organic acids of new wines.

As the author has shown, the organic acidity of wine is mainly due to acids that already exist in the grape (malic, tartaric, and citric acids) and to acids that form during alcoholic fermentation, the chief of which are lactic, succinic and acetic acids. These acids are present in determined proportions, which are altered by the addition of any one of the acids.

The author has made use of data from previous work carried out by him or in collaboration with M. MENSIO, and has drawn up two tables, in the first of which is given the ratio *total malic acid* × 100 : *titratable acidity* + *alkalinity of the ash,* and in the second the ratio *lactic acid* × 100 : *titratable acidity* + *alkalinity of the ash.* The figures given show that, for new wines, the content of malic acids is about 41 %, a value which decreases by one-half and more in old wines. The opposite occurs in the case of lactic acid, which may rise from an average of 10 % in new wines to 28-30 % in old wines.

Use was also made of previous analyses made by the author, of unpublished data from the Royal Oenological Station of Asti, and particularly of publications of the Italian Ministry of Agriculture relating to analyses of Italian wines made in the Ministry's Laboratories, and he has constructed, for some thousand wines from all the regions of Italy, the curves showing the variability of the ratio *total tartaric acid* × 100 : *total titratable acidity* + *alkalinity of the ash.* These graphs have led the author to conclude that, as the values of the suggested ratio vary with the region and the years, they must be applied with a certain latitude and discretion. Thus there are maximum values as high as 70 % for certain Tuscan wines and minimum limits of 7 % for certain wines from the province of Avellino, whereas the values vary between 15 and 45 % for Piedmontese, Emilian and Sicilian wines and are usually between 25 and 30 %.

In the presence of the continual complication of adulteration and of the means for detecting it, the author asks whether it would not be better to give the preference to the idea of legal commercial limits, rather than

to the too elastic one of purity. A proposal of this nature was made by prof. MARTINOTTI, Director of the Royal Oenological Station at Asti, at the Viticultural Congress held in Alba in 1908.

578 - **Determination of the Hydrogen-Ion Concentration of Wine.** — CASALE, L., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Part. 7-9, pp. 375-388. Modena, 1919.

The author (Royal Laboratory for Agricultural Chemistry of Avellino) puts forward a new method for determining the hydrogen-ion concentration (either the actual acidity or the acid energy) of wines and for ascertaining the total quantity of bases combined with each acid. By studying the hydrogen-ion concentration of numerous wines by means of the saccharose-inversion method, it was found that the data obtained were not always in proportion to the acid concentration. The proportion is lacking, for example, in wines of high acidity, wines for which the value of the hydrogen-ion concentration loses its importance and cannot be used for calculating the acids-to-salts balance. The author suggests a formula deduced from the calculation which gives the acid energy, a value that corresponds to the ratio of acid-base combination. In normal wines, in which the value is that deduced from the inversion of saccharose, the proportions of the two acids, malic and succinic, can be deduced algebraically. On applying these calculations, the author obtained values generally little different from those obtained with the other methods now in use and which are also of a mathematical character, since the succinic acid is calculated from the weight of alcohol (0.17 cc. of normal succinic acid to 1 gm. of alcohol) and because the malic acid is calculated by difference. As the ratio of succinic acid to alcohol is not constant in wine, the determination of the two acids by the method described above does not always give accurate results, whereas the algebraic method proposed by the author is more accurate.

579 - **Electrochemical Methods for Investigating the Addition of Sulphuric Acid to Wine.** — CASALE, L., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Pt. 10-12, pp. 549-568. Modena, 1919.

When wines with feeble coloration, or wines difficult to keep or even " diseased " are in question, the addition of a little sulphuric acid in such proportions as not to exceed the legal limits of the sulphates will obviate all these difficulties. This quite unhealthy practice is certainly illegal, but the chemist does not always discover the fraud because, with the uncertainty of analytical methods, the origin of the sulphates present in wine is hardly ever investigated when they occur in abnormal proportions.

The author states that none of the methods for investigating this type of adulteration discriminates with certainty between the addition of sulphuric acid and ordinary " plastering " (addition of gypsum). Since the chemical reactions showing the presence of sulphuric acid and the use of " plastering " are essentially the same, whilst the electrochemical reactions are different, the author investigated the question at the laboratory of agricultural chemistry at Avellino (Italy). The conclusions he arrived at are given below :

The addition of free sulphuric acid to wine produces an increase in the ash which does not correspond to the quantity of acid added. The alkalinity of the ash does not decrease in proportion to the acid added, but in a lesser proportion, and no neutral reaction is obtained even if the amount of sulphuric acid added is proportional to the alkalinity of the ash. The ash still remains alkaline even if more sulphuric acid is added than corresponds to the alkalinity of the ash itself.

The electrochemical determination of the ash in normal or plastered wines gives results that agree with those obtained gravimetrically, whereas, in wine to which sulphuric acid has been added, the figures obtained are higher than those obtained by the former method The addition of sulphuric acid to wine leads to the formation of both the neutral and acid potassium sulphate. The presence of these two salts can only be shown by electrochemical methods, the electrical conductivity of the wine being determined using the Wheatstone bridge.

580 – **The Behaviour of Artificial Colouring Matters in Wine.**— SCURTI, P. and RUATA, in *Le Stazioni sperimentali agrarie italiane*, Vol. L,II, Pts. 10-12, pp. 497-520. Modena, 1919.

The authors report investigations which demonstrate that, in certain cases, wines shown by a first analysis to be coloured artificially have been proved (e. g.), by a control analysis made by law, not to contain any artificial colouring matter.

On account of the importance of these observations as regards the prevention of fraud in the preparation and sale of wine, the authors have examined the question, especially regarding the extent to which the various factors which, in time, may have an influence on the disappearance of artificial substances added to wine, can be taken into account in practice. To this end, a large number of basic and acid dyes were studied as to :

(1) The action on them of the ferments and extract of the must during the period of most active fermentation.

(2) The action on them of the volatile and extractive matter in wine, particularly during slow fermentation.

(3) The action on them of the corrective materials used in oenological practice.

(4) The action on them of pathogenic organisms.

The results, which are given in a series of tables, can be summarised as follows :

The disappearance of artificial colouring matters in wine depends chiefly on the protein content of the wine in question and on the eventual presence of pathogenic organisms. A reaction is also apparently due to the tannins, since the dyes tend to disappear more quickly in red than in white wines. In consequence, the dyes disappear more quickly from must than from wine, more quickly from incompletely fermented wine than from dry wines, and more quickly from altered wines than from healthy wines.

Living agents differ from organic agents by their wider scope and,

in fact, whereas proteins and tannins can only remove the acid dyes, pathogenic organisms can free a wine from all the dyes added, no matter what their nature.

As regards the practical application of these observations, it is obvious that if a wine shown by analysis to be coloured artificially is afterwards kept in such a way that it becomes altered by disease, the fact that a fresh analysis reveals the presence of no dyes does not constitute a valid argument for annulling the first analysis. If, however, the wine remains unaffected, two cases will have to be considered in the event of a second analysis :

(1) *An acid dye was used* (the nature of the dye is usually clearly shown by the tests used to identify it). — In this case, the second analysis, specially if made some time after the first, also has little value, because the artificial colouring matter has combined with the albuminoids and tannins in the wine and may no longer be identifiable by analytical methods.

(2) *A basic dye was used.* — In this case, the control analysis is fully reliable, because basic dyes remain practically unchanged in healthy wines.

581 – **Researches in Fluorine in Wine, in Italy.** — ZAY, C., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Pts. 10-12, pp. 485-489. Modena, 1919.

The author reviews the scanty literature dealing with the presence of fluorine in wine and in the grape, and draws the conclusion that, although fluorine is biologically a normal constituent of wine, natural wines must be considered from the commercial point of view as free from this element, as it only occurs in minimum and negligible quantities.

Studying the question from the standpoint of Italian wines, the author examined samples of undoubtedly natural wines from Piedmont, Lombardy, and the region around Venice. Some thirty wines were analysed, but only slight traces of fluorine were found.

To find out whether, in soils exceptionally rich in fluorides, the vines could assimilate large quantities of fluorine and thus yield grapes and, consequently, wines with a high fluoride content, the author carried out an experiment lasting two years in which he watered vines (in 10 different vineyards) with fluoride solutions of 0.25 per 1000 or 1 per 1000 strength. The wines made from the grapes produced by these wines were found to contain but traces of fluorine, as did the lees deposited in the fermentation tanks.

The conclusion was then drawn that fluorine is normally present in natural wines, but in such small amount that its quantitative estimation is not possible by means of ordinary methods, whence it follows that if commercial wines contain fairly large quantities of fluorine, it can be assumed that this element has been added artificially.

582 – **On the Plastering of Wine** (1). — BORNTRAEGER, A., in *Le Stazione sperimentali agrarie italiane*, Vol. LII, Pt. 7-9, pp. 349-360. Modena, 1919.

An investigation of the influence on the reaction between cream of tartar and gypsum of : (1) Alcoholic fermentation ; (2) the duration of

(1) See also *R.*, Nov. 1917, No. 1063 and *R.*, July, 1918, No. 814. (*Ed.*)

the contact between gypsum and grape ; (3) the relative quantity of gypsum ; (4) the presence of whole marcs ; (5) the separation of the grapes from the bunch. The results obtained show that : (1) The total marc present has a considerable influence on the quantitative results of plastering ; (2) the stalks have little effect in this respect ; (3) the addition of 1 % of gypsum to the grapes was more than sufficient to obtain the highest possible plastering in the kinds of grape used (Catalanesca, Rosa, Befania, Sanginella, Isabella) ; (4) the degree of plastering increases up to a certain point with the rise in temperature ; (5) plastering takes place rather rapidly in small-scale tests made at 21.5-24.5° C., and in 48 hours if frequent agitation is applied ; (6) the alcohol that forms leads to a decrease in the initial content of sulphates, owing to the precipitation of the gypsum that had merely dissolved in the must.

583 – **On a Simplified Method of Sugar-making : the Production of Red Beet-Sugar with the Beet Taste.** — The Kestner process, described by M. LINDET before the Académie d'Agriculture ; remarks by M. E. PLUCHET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 11, pp. 291-293. Paris, March 17, 1920.

M. KESTNER, of Lille, wondered whether it was worth while for the French beet-sugar makers to produce a sugar as white as that ordinarily used ; provided such sugar would only be used for certain purposes, e. g., sweetening coffee, in chocolate, cakes, etc. For this reason he produced a red sugar by the direct evaporation of slightly purified beet juice.

At first, M. LINDET cast doubts upon the process, since beet sugar always retains something of the taste of the beet ; in fact, so much so, that makers of champagne wines no longer sweeten champagne wines with beet sugar, no matter how purified it may be ; the taste even reappears some years after the sugar was first added.

M. KESTNER found an elegant solution of the problem. In his process, the beet juice is heated to 125 or 130° C, a temperature which does not affect the juice, but causes the beet taste to disappear. The juice is prepared by the usual diffusion method and purified by adding an amount of lime equal to only half of that usually employed ; the juice is then passed through a filter-press and evaporated at 125 or 130° C. In this way, he obtains a slightly alkaline syrup which he saturates with phosphoric acid and evaporates (to a consistency almost like that of putty) at 130° C, at which temperature the beet taste disappears. The thick syrup sets and gives crystalline sugar.

It was M. KESTNER's idea that beet sugar could be made in this way in small sugar factories, particularly in regions such as the South-west, where the sugar-beet is not grown. M. LINDET thinks, however, that the small works he had in view were destined to become large factories, for a works always engenders has a certain outfit, the cost of which must be paid out of the general expenses ; he is of opinion that this process would have a chance of succeeding in the sugar factories in northern France, as they are gradually reconstructed. It requires less material and labour, since it does away with carbonatation, sulphitation, clarification, etc.,

and working up the by-products. The fiscal question still requires solution, as the Revenue authorities wish to tax this sugar at the same rate as pure sugar, i. e., on the net weight; but it only contains 86 % of saccharose, and this alone should be taxed.

M. KESTNER asks that the same rule as that applied in refineries, the rule of yield, should be applied to this sugar, and, in this case, there would be a deduction of 15 to 18 % on which no tax should be paid. The Revenue authorities ought to go into this question.

In any case, it appears that 3 sugar factories, one in the South-west, will be established to work next season's crop according to this method. It will be interesting to know the results obtained.

M. E. PLUCHET asked M. LINDET whether this process would not require a large amount of fuel, seeing that the evaporating temperature is 130° C, and whether the present high price of coal would not make the process very costly. With evaporation in a vacuum, evaporation is obtained at a much lower temperature than 100° C.

M. LINDET replied that he had no data which would enable him to answer the question, but he would go into the matter.

584 - **The Chemical Composition and Industrial Utility of « Ye Goma » Oil.** — *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year IV, 1919-1920, No. 28, p. 122. Paris, January-February, 1920.

The Chemical Department of the Jardin Colonial (Nogent-sur-Marne, France) has examined a sample of the seed of the " Eno Abura " of Japan also known as " Ye Goma " and " Sudza " (*Perilla ocymoides* L.), which yields a drying oil in fair amount. The results of the examination were as follows:

Moisture	8.80 %
Fat	39.27 »
Nitrogenous matter	22.75 »
Ash	4.38 »
Not estimated	24.10 »

Ye Goma oil is used in Japan for warding off insects and for waterproofing clothes, parasols, and paper. When incorporated with lac it yields a brilliant and translucent yellow varnish.

585 - **Mangora Oil.** — See No. 525 of this *Review*.

586 - **The Preparation of Soya Sauce in Kwantung, China.** — GROFF, E. H., in *The Philippine Journal of Science*, Vol. XV, No. 3, pp. 307-316, 7 pl. Manilla, Sept., 1919.

The preparation of soya sauce in China does not constitute merely a home industry, but is often a true commercial industry, carried out in large factories. But it is always very difficult to obtain information as to the methods of manufacture and to obtain entry into the works. For this reason, the author, having been able to study the whole process followed in a factory in Canton, gives a description of the process, accompanied by photographs of the plant, etc., and the different stages of manufacture.

The process described comprises the following operations : The soya seeds are placed in a boiler, covered with water (14 parts by weight of the former to 11 parts of the latter), and boiled until soft, care being taken to prevent them getting crushed ; when boiled, the beans are drained in bamboo baskets, allowed to cool, then spread on a table and mixed with flour (12 of flour to 14 of beans), taking care not to break the seed coat and making sure that each bean is covered with flour ; the beans are now placed on racks to a depth of some 4 cm., and arranged with the fingers so as to allow free circulation of air ; the racks are made of bamboo, and are usually round, 90 cm. in diameter and with a side 4 cm. deep. The racks are piled one above the other in a dark " moulding " room ; in three days after being placed in this room, moulding begins and is complete in one or two weeks, according to the season. The flour-covered mouldy beans are placed in earthenware jars (46 cm. high and 47 cm. in diameter) which have been exposed to the sun for some months, and which are then filled up to the brim with a 27 % solution of common salt. The jars are left in the sunshine for from 2 to 6 months (the product is all the better the longer the exposure ; during the night or when it rains the jars are covered with bamboo mats). The exposure to the sunshine leads to the evaporation of the liquid with which the jars were filled ; for this reason, 3 days before some of the sauce is siphoned off, the jars are again filled with salt solution. The $^{6}/_{15}$ of the liquid in the jar is siphoned off ; the jar is allowed to stand, and more liquid is siphoned off until only $^{1}/_{3}$ of the content is left. The sauce first extracted is the best and most costly ; before being put on sale, it is again exposed to the sun for from 1 to 6 months, sometimes as much as 2 or 3 years. The addition of salt water, exposure to sunshine, filling up, and siphoning off the liquid are repeated 3 more times ; in this way, the quality of the sauces obtained deteriorates and these sauces are mixed together for sale. In some factories, instead of exposing the residue from the previous extraction to the sun, it is boiled to obtain the 2nd, 3nd and 4th extractions of sauce, but though this gives a product that sells very cheaply, it is of very poor quality.

The mould which gives the sauce its characteristic perfume and taste is yellow and is probably an *Aspergillus ;* a black, injurious mould, a *Mucor*, sometimes appears, but all the beans covered with this black mould are rejected.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

58 / – **The Cost of Milk to Producer and Consumer in the U. S. A.** — PEARL, R., in *Hoard's Dairyman*, Vol. XVII, No. 4, p. 148. Fort Atkinson, Wis., Feb. 14, 1919.

The author gives the following information in tabular form : (1) The prices obtained by farmers who sold milk in 9 cities in the U. S. A. in each year from 1913 to 1918 (first half-year) ; for the extreme years, these were, in cents per quart on 3.5% milk, New York 35 and 66, Boston 36 and 74, Philadelphia 34 and 65, Chicago 38 and 56, Buffalo 41 and 66, Baltimore 41 and 70, Pittsburgh 30 and 60, Cleveland 32 and 58, Washington 42 and 79. Compared with the figures for 1913 there were the following percentage increases in respect of each town : 88.6, 105.5, 91.2, 47.4, 61.0, 70.0, 100,

81.3, 88.1 ; (2) the average prices obtained for 11 other farm products were, on the average for the U. S., as follows :

Products			Price in 1913	Price Jan.-June 1918	Increase %
Milk	per	*quart*	$ 0.037	0.066	78.4 %
Wheat	per	*bushel*	» 0.787	2.024	157.2
Maize	»	»	» 0.594	1.483	149 7
Potatoe	»	»	» 0.642	1.021	59.0
Butter	»	*pound*	» 0.269	0.416	54.6
Hogs	»	*dozen*	» 0.218	0.379	73.9
Pigs	»	*cwt.*	» 7.494	15.473	106.5
Cattle	»	»	» 5.892	9.373	59.1
Sheep	»	»	» 4.542	11.458	151.6
Lambs	»	»	» 6.050	14.570	140.8
Onions	»	*bushel*	» 0.957	1.528	59.7
Beans	»	»	» 2.221	6.822	207.1

In a third table, the prices paid to the producer and the retail price for milk in each of the above-mentioned towns during 1913, 1917, and the first 6 months of 1918 are compared.

Taking the average of these nine cities, it will be found that the farmer's share for milk during the first 6 months of 1918 are 78.4 % higher than those of 1913. This increase in price is greater than that of potatoes, butter, eggs, cattle, and onions, and is smaller than that of wheat, maize, hogs, sheep, lambs, and beans. The percentage increase in the price of milk during the first 6 months of 1918, compared with the same period of 1917, was greater than that of any other food product, three of which (potatoes, onions, and haricot beans) decreased in price. Except in Chicago and Buffalo, the producer received a higher percentage of the price paid by the consumer in 1918 than in 1913.

588 – **Milk Production in Southern China.** — See No. 558 of this *Review*.

589 – **The Fungoid Flora of Brie Cheese.** — LOUBIÈRE, A., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 6 pp. 336-339, 2 fig. Paris, Feb. 9, 1920.

Amongst the fungi which grow on the surface of Brie cheese, the only ones that have been recorded and studied as yet, are several species of *Penicillium*, which are supposed to play a part in the process of ripening.

When the curd is left alone, it undergoes a series of changes. The micro-organisms disseminated in the mass, attack the lactose and casein, and bring about various fermentations ; the milk sugar, in particular, undergoes a lactic fermentation and the nitrogenous matter, under the influence of proteolytic enzymes, is transformed to caseone. However, if these proteolytic ferments are to display their normal activity in the coagulum, this must be neutralised or even become alkaline. And it is owing to the intervention of the moulds that grow on the surface that the

organic acids, particularly lactic acid, undergo progressive combustion and are finally destroyed. On account of the important part thus played by these fungi in ripening, the author has investigated the question and now publishes his first results.

When samples from different ripening cellars were examined systematically, it was found that the fungoid flora of Brie cheese was much more complex than had previously been thought. During ripening, besides the well-known species of *Penicillium*, a whole fungoid flora develops; this flora includes, in order of frequency: *Fusarium sarcochroum* Desm. and *Geotrichum candidum* Link, which are almost constantly present; then, much less frequently, *Trichosporium* sp. and *Botryotrichum piluliferum* Sacc. and March; finally, on dried-up, ripe specimens, *Hormodendron cladosporioides* (Fresen.) Sacc., *Gymnoascus luteus* Zuck. and a species of *Lasiobotrys* are often found.

All these fungi develop solely their conidial form, with the exception of the last one, which develops perithecia in culture tubes. The author gives interesting new details about two species, *Trichosporium* sp. and *Hormodendron cladosporioides*.

590 – **The "Xarque" (Dried Meat) Industry in Brazil; Production and Exportation.** — *Bulletin commercial de la Section des Affaires économiques et commerciales du Ministère des Relations extérieures de la République des Etats-Unis du Brésil*, No. 8, p. 22; No. 9, pp. 6-5. Rio de Janeiro, 1919.

"Xarque" is dried, salted meat; its manufacture dates back over a century in Brazil and the methods used have been imitated in other South-American countries. Xarque is one of the products that helped most in developing Brazilian cattle, especially before the war, as the cold-storage industry has only been established in the country since then.

The xarque industry of Brazil is very advanced, whether on account of its plant or for the product itself and its derivatives, and large amounts are invested in it. The production of xarque in the different producing states is as follows:

Rio Grande do Sud	46 000	metric tons
Minas	7 500	» »
Matto Grosso	1 500	» »
São Paulo	3 000	» »
Goyaz	553	» »
Rio de Janeiro	500	» »

Prior to the war, trade in this product was limited to the states of Brazil, and recourse was necessitated to imports from other South-American countries to satisfy home demands. Since 1914, however, exportation has begun and developed rapidly. The exports from 1913 to 1918 were as follows: **1913,** 21 tons; **1914,** 138 t.; **1915,** 2 265 t.; **1916,** 7 122 t.; **1917,** 8 728 t.; 1918, 4 809 t.

591 – **A Native Method Used for Preserving Meat at Fez, Morocco.** — CARPENTIER, in the *Recueil de Médecine vétérinaire*, Vol. XCV, No. 5, pp. 149-156. Alfort, 1919.

Description of a native method used in Morocco for preserving meat, particularly beef. The meat is sterilised by the triple action of salt, drying,

and heating, whilst external contamination is avoided by covering with a layer of fat. The author observes that this method combines practically all the known methods for preserving meat.

592 – **Country Hides and Skins.** — WALIN, C. V., FREY, R. W., VEITCH, I. P. and HICKMAN, R. W., in *U. S. Department of Agriculture, Farmers' Bulletin* 1055, p. 64, figs. 46. Washington, August, 1919.

A joint contribution from the Bureaus of Markets, Chemistry and Animal Industry.

Country hides and skins make up more than one-third of all the hides and skins produced in the United States, and their condition on arrival at the tannery is of vital interest to all who use leather. Too often the value of "country" hides for leathermaking is less than that of "packer" hides, because less care and skill are shown in the "take off" and in curing and handling. In consequence the hide trade discriminates between "country" and "packer" hides and skins and pays less for the former.

This bulletin shows how farmers, ranchers and butchers may produce hides and skins of better quality. It gives detailed directions for skinning the animals and for salting, curing, and handling the hides and skins, with suggestions for more advantageous marketing, in order that that both the producer of hides and the user of leather may be benefited.

The market classes and grades of both packer and country hides and skins are also defined and the main defects of country hides and skins, and the waste resulting from faulty practices, are indicated. Statistical information in tabular and graph form as to market prices and price fluctuations is included in the appendix.

[591-592]

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

593 - **Behaviour of Hybrid Direct Bearers as Regards Disease during the Drought in 1919 in Touraine, France.** — See No. 488 of this *Review*. RESISTANT PLANTS

594 - **The "Laorcas" Vine, Resistant to Oidium, in Cyprus.** — *The Cyprus Agricultural Journal*, Vol. XIX, Pt. 3 and 4 ; Vol. XV, Pt. 1, p. 146. Nicosia, July-Oct., 1919-January, 1920.

During 1919, a vine was found in the Heloan property, at Alethrico, which was completely immune to *Oidium Tuckeri*, whereas all the surrounding vines were severely attacked by the fungus. It was found that this vine came from Ayros Ambrosios (Kyrenia district), where it is known as "Laorcas." The Agricultural Department will carry out experiments to ascertain the persistency of the immunity enjoyed by this vine.

595 - **Action of Chloropicrin on Various Fungi.** — MATRUCHOT, L. and SÉE, P., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIII, No. 7, p. 170-171. Paris, February 21, 1920. MEANS OF PREVENTION AND CONTROL

The toxic action of chloropicrin on animals (1) suggested to the authors the idea of trying its action on fungi. They used a closed area in which the air was saturated with toxic vapour. The fungi were left in this air for periods varying between 7 minutes and 8 hours, then withdrawn and immediately replanted to ascertain their vitality. The experiments showed that the most fragile fungi are : *Hypomyces ochracea* (conidia and chlamydospores), killed without fail after 30 minutes ; then *Mucor Mucedo* (sporangia), *Botrytis cinerea* (conidia), *Sclerotium echinatum* (sclerotia), killed after 3 ½ hours ; then *Nocardia* sp. (arthrospores), *Pènicillium* sp. (conidia), *Amblyosporium* sp. (arthrospores), and *Chaetomium bostrychodes* (perithecia), which die after period of contact longer than 5 hours 40 minutes and shorter than 8 hours.

In an atmosphere not saturated with chloropicrin, but containing 10 cgm. per litre of air, all the fungi except *Amblyosporium* sp., were killed in 48 hours, and double the strength killed even that fungus in 42 hours.

(1) See R., July-Sept., 1919, Nos. 1049 and 1050 ; *R.*, Jan., 1920, Nos. 6 and 148 ; *R.*, Feb., 1920, No. 274 ; *R.*, March, 1920, Nos. 374 and 378. (*Ed.*)

The fungi experimented on belonged to very different groups and represented the most varied vegetative or reproductive forms (mycelium, arthrospores, conidia, chlamydospores, sclerotia, perithecia) and it may be concluded from the results that chloropicrin will completely disinfect an enclosure, in respect of any fungi it contains. It suffices to employ the toxic vapour at saturation point for 8 hours, or at a smaller concentration during a longer time which, however, is apparently not more than a few days.

596 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 572 of this *Review*.

DISEASES OF VARIOUS CROPS,

597 - **The Behaviour of Certain Varieties of Wheat as Regards Smut, in Emilia, Italy.** — PEGLION, V., in *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, and, Half-year, 1919, Vol. XXVIII, Part 10, pp. 398-400. Rome, 1919.

Researches on 34 samples gathered in the field or taken succesively from parts of wheat recognised as smutted, by the Commission for the requisition of cereals in the province of Bologna, showed that 14 samples from various localities in that province were attacked by *Tilletia Caries* (= *T. Tritici*), while 20 samples from the lower Ferrara district and from various localities in the provinces of Bologna, Modena, and Ferrara, were attacked by *T. laevis*. A few samples were affected by both species. The samples belonged to the varieties Gentil rosso, Inversable, Rieti, Cologna, and one came from a field of Carlotta Strampelli.

Gentil rosso and Inversable suffered most, but a marked resistance was noted in fields sown with Cologna, and which could be considered as practically free from the disease, as, all things being equal, only occasional ears were smutted, whereas, in adjacent plots, the Gentil rosso and Inversable varieties were severely attacked.

The variable degree of resistance of the species and varieties of *Triticum* in respect of smut has been the subject of various researches, amongst which those of TUBEUF, KIRCHNER, and HECKE are particularly instructive. These investigations show that the practical value of a wheat variety as regards its behaviour towards smut is the result of 2 factors: the intrinsic resistance and the degree of germinating energy. Consequently, to judge the resistance of wheats to smut, it is sufficient to have recourse to the same criteria as those used in judging the resistance of wheats to rust.

The intrinsic resistance is independent of the degree of germinating energy, which influences the behaviour of wheat in respect of smut in a similar way as the earliness of the vegetative cycle does in respect of rust.

Early wheats like the Cologna variety escape attack; thus, varieties of wheat with considerable germinating power, like the Ohio wheat used by TUBEUF and APPEL, appear likely to escape smut. But KIRCHNER'S experiments, confirmed by HECKE, have shown that this estimate does not possess absolute value and, just as it should not be concluded that a variety with feeble germinating power is liable to smut, similarly a high

germinating power is not a sure sign of resistance to infection. It follows that, on lowering the germinating energy — which closely depends on the conditions of moisture and temperature under which germination takes place — it will be relatively easy to show the degree of resistance possessed by varieties of wheat.

The author has applied this theory to the study of 13 selected families of wheat grown on a large scale ; the sample grains were uniformly covered with spores of *T. laevis*. One part of the seeds was sown in large pots on November 21, 1918 ; the rest was sown in rows in the field on November 23. Germination was very slow and the first shoots began to show only on December 15.

The results obtained in July, 1919, are summarised in the appended table :

Families	No.	Total ears obtained	Healthy ears.	Infected ears.	Percentage of infected ears
Cologna	12	208	138	70	33.6 %
Zucchette	238	332	210	122	36.7 »
Cologna	29	184	101	83	45.1 »
Zucchetto	235	181	91	90	49.7 »
Carosello	11	229	99	130	56.7 »
Turgido	255	207	80	127	61.3 »
Gentil rosso . . . / Demi-aristé	48	200	76	124	62.0 »
Marzuolo	83	821	297	524	63.8 »
»	87	347	114	233	67.1 »
Romanello	211	169	50	119	70.4 »
Inverrable	179	82	24	58	70.7 »
Rieti	39	198	56	142	71.7 »
Romanello	187	248	64	184	74.1 »

The extremes of this scale (Cologna No. 12 = 33.6 % ; Romanello No. 187 = 74.1 %) are much more distant than those found between *Triticum polonicum*, *T. polonicum* × *T. vulgare*, and *T. vulgare* in HECHE's experiments (23.5 % and 40 %). On confronting this result with the observation previously cited regarding the almost absolute immunity of Cologna, grown in soils where other wheats were decimated by the disease, it can be concluded that this variety, like Zucchetto, is endowed with considerable resistance to the attacks of *T. laevis*, a fact which the author thinks should be taken into account in the improvement of wheat by selection or crossing.

598 – ***Pythium Butleri* n. sp., a Peronosporaceous Parasite of Various Cultivated Plants in India.** — SUBRAMANIAN, L. S., in the *Memoirs of the Department of Agriculture in India*, Botanical Series, Vol. X, No. 4, pp. 181-194, 6 pl. Calcutta, 1919.

During the last few years, phenomena of withering and rotting to a fairly large extent have been observed in nurseries of young tobacco and pepper plants in Pusa and the surrounding district. These phenomena coincided with the presence of *Pythium*, which is now known to be the cause of these alterations.

The disease had already been found on pimento near Surat (Bombay) and at Rangpur (eastern Bengal), and on the papaw tree in Kathiavar (western India) at Dacca, and in Burma.

When the fungus, isolated from tobacco, ginger, and the papaw tree, was inoculated into these plants, as well as pimento, the potato and castor plant, the inoculation gave clearly positive results in most cases.

The species of *Pythium* in question is described by the author as new to science under the name of *P. Butleri*.

In the case of ginger, the disease is propagated chiefly by the use of infected rhizomes in new plantations, and, in rare cases, by the soil itself if water logged. To control the disease, the measures advised include the burning of all diseased ginger plants, the use of crop rotations and healthy seed, perfect draining, and careful destruction of all weeds.

The disease is very harmful to the papaw tree in damp seasons. The diseased portion of the tree should be completely removed as soon as signs of attack are shown, and the wound thus caused by cutting should be treated with liquid antiseptics.

As regards tobacco and pimento, treatment of the nurseries with chemical was not found efficacious. If the soil, however, is sterilised by burning the dry vegetation present in the nurseries, this acts as a preven tive measure

599 – ***Catalpa bignoniodes* × *C. Kaempferi*, Resistant to Low Temperatures and to Attacks by *Macrosporium Catalpae*.** — See No. 517 of this *Review*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERAL

600 – **Insects Injurious to Cultivated Plants in Morocco.** — VAYSSIÉRE P., in the *Bulletin de la Société entomologique de France*, No. 18, pp. 340-342. Paris, 1919.

Using specimens sent during recent years to the Entomological Station at Paris, and others collected during a visit in the spring of 1919, the author has drawn up a preliminary list of the insects injurious to cultivated plants in Morocco. The list includes the following species :

A) Orthoptera

(1) *Schistocerca tatarica* L., the most serious pest in Morocco.

(2) *Dociostaurus maroccanus* Thunb., of secondary importance of recent years to Moroccan crops, as it has not appeared in numbers for some time.

(3) *Gryllotalpa vulgaris* L., very common, particularly in the Fez region, where the town nurseries suffer considerably.

B) Coleoptera

(1) *Tropinota crinita* Charp., occurred in great numbers in 1919 in the Figuig and Bou-Denib oases, where the insect devoured the flowers of kitchen garden and ornamental plants, particularly beans, iris and roses.

(2) *Cassida viridis* L., collected at Taza on cultivated artichokes ; it has probably been introduced recently, as it is not widely distributed.

(3) *Colaspidema atrum* Ol., indentified from larvae gathered in large

numbers in a lucerne field at Marrakech, where it caused serious damage in early spring, 1919 ; the natives have only noticed it since 1918.

(4) *Labidostomis hordei* F., in vine buds at Meknes (1).

(5) *Capnodis tenebricosa* Ol., common in nurseries at Fez, where its larva is very injurious to fruit trees (peach and cherry).

(6) *Laria pisorum* L., causes considerable damage to pea crops and in stores in the Meknes and Rabat regions.

(7) *Larinus afer* Gyll. and *L. flavescens* Germ., very harmful to artichokes (by mining the stems) on farms to the north-east of Casablanca.

(8) *Lixus scabricollis* Bohem., named from an imperfect specimen on beet in the Fez region.

(9) *Xyleborus dispar* F., has developed in large numbers on stone-fruit trees, especially at Fez and Rabat ; the trunks are literally riddled with the holes of this Scolytid.

C) L e p i d o p t e r a

(1) *Zeuzera pyrina* L., appeared at Fez and Rabat as a veritable pest of fruit trees ; the author found 6 larvae in one quince tree.

(2) *Leucania* (*Heliophila*) *unipuncta* Hw. ; a larva whose identification ought to be examined carefully is reported to have ravaged the fields in the Fez region from January to March of late years ; it is said to attack all crops, especially graminaceae.

(3) *Sesamia nonagrioides* Lef., very harmful to young sugar-cane plantations at Sidi Ali (Azemmon) and at Rabat.

(4) *Phthorimaea operculella* Zell., can be considered, after *S. tatarica*, as the insect most injurious to crops in Morocco ; it offers a serious hindrance to the extension of the potato crop in the country ; available information shows that this pest has been long present in the country (2).

(5) *Phycita diaphana* Stgr., said to have attacked the leaves of the castor plant in 1917 at Rabat.

(6) *Earias insulana* Gn., is the sole pest found by the author on cotton plants at the Fez Experimental Farm.

(7) *Lita ocellatella* Boyd., has increased to large numbers in the beet crops in the Fez region since 1917 (3).

MEANS OF PREVENTION AND CONTROL

601 – **New Studies on *Sorosporella uvella*, a Fungoid Parasite of Noctuidae in America** (4). SPEARE A. T., in *Journal of Agricultural Research* Vol. XVIII, No. 8. pp. 399-439. Washington D. C., Jan, 15, 1920.

Observations mainly of a biological nature on *Sorosporella uvella* (Krass.) Gd., a fungus recorded from the eastern United States and from Canada

(1) See *R.*, Oct.-Dec., 1919, No. 1298. (*Ed.*)

(2) See *R.*, Jan., 1919, No. 140 and *R.*, March, 1919, No. 404. (*Ed.*)

(3) Besides the species listed here, the beetle *Cyrtognathus forficatus* L. and the Lepidopteron *Thaumetopea* (*Cnethocampa*) *processionea* L., have been reported as injurious to the vine and cork-oak respectively, in Morocco, as well as other insects. See *R.*, July-Sept., 1919, No. 1057, and *R.*, Oct.-Dec. 1919, No. 1305. (*Ed.*)

(4) See *R.*, June 1917, No. 611 and *R.*, April, 1918, No. 494. (*Ed.*)

as a parasite of various species of Noctuidae. The observations are based on the study of artificial cultures of the fungus, on inoculation experiments on various living hosts, and on the histological study of infected insects before and after death.

It is now admitted that the fungus in question should be classed not with the *Entomophthorales*, but with the verticillate Hyphomycetes until its perfect or ascigerous stage is discovered. In fact, the development and structure of the conidiophores of *S. uvella*, and the formation of the conidia are characteristic of the latter group of fungi.

The fructifications of the parasite in question consist of thick-walled resting spores or chlamydospores and thin-walled conidia ; the latter have now for the first time been definitely connected with the life cycle of the fungus.

It has been shown that the special, saccharomycetiform vegetative cells present in the blood of infected insects are ontogenetically connected with other phases in the cycle of the fungus. These cells are ingested by some of the white blood-corpuscles (phagocytosis) and this is apparently followed by the destruction of the phagocytes. This phenomenon has been overlooked by those who have studied the fungoid diseases of insects.

The fungus grows quickly on artificial media and shows two entirely different types of development when cultivated on the appropriate medium. In certain cases, whether the fungus is cultivated on artificial media, or whether the chlamydospores are put in damp cells, fruiting structures of the *Isaria* type are produced.

The disease caused by *S. uvella* is rapidly transmitted to healthy insects ; in laboratory experiments a mortality varying between 60 and 90 % can soon be obtained.

602 – ***Prospaltella berlesei*, a Hymenopterous Parasite of *Diaspis pentagona* in France.** FOUTIERS, S., in the *Bulletin de la Société entomologique de France*, No. 18, pp. 334-335. Paris, 1919.

As attention was drawn towards the end of 1918 to the appearance of *Diaspis pentagona* in France at various points on the Mediterranean shore (1), researches were begun with the aim of finding whether this scale insect was controlled by its natural parasite, *Prospaltella berlesei*.

The number of pierced scales of *D. pentagona* furnished an almost certain sign of the presence of the parasite. In fact, a number of microscopical preparations and rearing the adult insect in breeding bottles provided absolute confirmation of the forecast made.

INSECTS, ETC. INJURIOUS TO VARIOUS CROPS

603 – ***Bruchus rufimanus*, a Beetle Injurious to Beans in California.** — CAMPBELL, R. E., in the *U. S. Dept. of Agric., Bulletin* 807, pp. 1-22, 6 fig., 1 Pl. Washington, D. C., January 27, 1920.

Of late, bean growing, in California has been seriously affected by the presence of the bean weevil (*Bruchus rufimanus* Boh.).

Although this beetle was recorded for the first time in the United

(1) See *R.*, March, 1919, No. 408. (*Ed.*)

States in 1909, it has probably been present there since 1888. Wherever beans are grown in California, the beetle has been found ; it not only decreases the value of the product, but it has even led the farmers to reduce considerably the area devoted to the crop.

B. rufimanus has one generation a year and does not develop in dried beans. The egg stage lasts 9 to 18 days, the larval stage 10 to 15 weeks and the pupal stage 7 to 16 days ; the adult lives from 1 to 8 months. The eggs are laid on the green pods in the fields from the middle of March to the middle of May ; the larvae are full-grown by August and September and the adults can be found from August to the June of the following year.

The damage caused by the bean weevil is mainly due to the fact that the larva feeds and becomes the perfect insect inside the seeds Many imagines remain in the seeds for several months, thus rendering them unfit for food, but other imagines leave the seeds as soon as they have passed the pupal stage, leaving round holes in the seeds at the place where the larvae have fed on the tissues. The appearance of these seeds decreases their chance of sale and, moreover, the seeds are not only lighter but have a reduced germinating power. The germination power of infested beans is 20 to 40 % less than that of healthy ones. The germination of seeds one year old or more is only slightly less than that of new seed.

In America, there are no natural enemies of the beetle that provide an efficacious and sure control.

Exposure to a temperature of 77-82° C for over 90 minutes kills all the beetles present in the seeds. Fumigation with sulphur is not an efficient method of control. Carbon disulphide in the proportion of 112 gm. per cu. metre in a hermetically closed receptacle, causes the death of all the *B. rufimanus* in the seeds. It has been found that, in seeds kept for two years, all the beetles were dead. Seeds from late crops (after March 1) are much less attacked than those from early crops (Nov. to March).

604 – **Insect Pests of the Groundnut in Queensland.** — Jarvis E., in the *Queensland Agricultural Journal*, Vol. XII, Part 4, pp. 200-204, 1 pl. Brisbane, 1919.

The insects listed below were observed by the author at Meringa, near Nairns (Queensland), on groundnut plants belonging to the Spanish variety, grown for home use. Little or nothing has yet been published on insect pests of the groundnut in Australia, probably, on account of the small area of the crop in that country.

The following insects attack living plants :

(1) *Pseudococcus* sp., very similar to if not the same as *P. trifolii* Forbes recorded from South America, where it chiefly attacks clover ; about 30 % of the crop suffered in varying degree from attack by the scale ; various stages of the scale were on the roots and other subterranean parts of the plant and were present in such numbers on the fruit as to cover them completely ; in certain cases, most of the fruits on each plant were decayed and the foliage had faded; apparently, *P. trifolii* had not previously been recorded on the groundnut in Queensland.

(2) A Pyralid (*Glyphodes* sp., or another microlepidopteron closely

related to that genus) ; in March, the larvae join the leaves of the plant together with silken threads, and eat the young shoots and leaf buds in the shelter thus provided.

(3) *Laclia* sp. (fam. *Lymantridae*) ; adults of this Noctuid moth were reared in February from larvae found eating groundnut leaves.

(4) *Chloridea assulta* Gn. (= *Heliothis assulta*) ; the larvae of this Noctuid were fairly common and damaged the young leaves and tender shoots.

(5) *Chl. obsoleta* F. (= *H. armigera* Hb.) ; a few larvae attacked the young leaves to a slight extent.

(6) *Atractomorpha crenaticeps* Blanch. (fam. Acridiidae).

(7) *Cyrtacanthacris* sp. (fam. Acridiidae) ; this orthopteron, like the previous one causes slight damage to the leaves.

(8) *Isodon puncticolle* (fam. Scarabaeidae) ; the adults of this beetle were recorded from Sandgate in 1917 as damaging the plants by eating the stems just below the surface of the soil.

Insects that attack stored groundnuts :

(1) *Homoeosoma vagella* Zell. (fam. Pyralidae) ; the larvae of this Pyralid attacked some Giant Peanut groundnuts from Cairns ; they live on the seeds and, when full grown, they leave the pods and pupate in silken cocoons.

(2) *Tribolium ferrugineum* Fab. (fam. Tenebrionidae) ; common in stored groundnuts ; *T. confusum* Duv. has already been reported as injurious to groundnuts in America.

(3) *Carpophilus* sp. (fam. Nitidulidae) ; some adults of this beetle were attracted by dry groundnuts kept in a tin ; they probably fed on broken nuts, residues, etc.

605 – **_Coelaenomenodera elaeidis_ n. sp., a Beetle harmful to the Oil Palm (_Elaeis guineensis_), in the Gold Coast, Africa.** — MAULIK, S., in the *Bulletin of Entomological Research*, Vol. X, Pt. 2, pp. 171-174, 3 fig. London, January, 1920.

The author describes, as a new species, a beetle named *Coelaenomenodera elaeidis* (sub-fam. Hispinae, fam. Chrysomelidae), which is reported to be injurious to the oil palm (*Elaeis guineensis*) in the Gold Coast, Upper Guinea.

From information supplied by Mr. W. H. PATTERSON, Government Entomologist in that British colony, the insect has suddenly become injurious and is said to have destroyed all the leaves already open of several thousand palms in a single district. A similar invasion occurred in 1909, but ceased as soon as the next rainy season came on ; after that period the insect was very rare. The total damage is apparently considerable when the beetle is numerous. Regarding the nature of the damage, the larvae bore galleries in the young buds and the adults destroyed the young leaves

606 – **An Unidentified Dipterous Pest of Celery in Cyprus.** — *The Cyprus Agricultural Journal*, Vol. XIV, Pt. 3-4, Vol. XV, Pts. 1, p. 152. Nicosia, July-Oct., 1919, Jan. 1920.

A dipteron belonging to the sub-family *Trypaneidae*, but not yet specifically identified, was recorded in 1919 on celery, which was attacked by

large numbers of the insect. The dipteron lays its eggs on the leaves, and the larvae mine in the leaf, eating the parenchyma.

The presence of the larvae is shown by patches of varying extent on the leaves. All attacked leaves should be cut off and burnt at once ; this prevents the appearance of a second generation of the dipteron and, consequently, a second attack.

607 - ***Neophyllaphis podocarpi* n. gen., n. sp., an Aphid Observed on *Podocarpus macrophylla* in Japan.** — TAKAHASHI R., in the *Canadian Entomologist*, Vol. LII, No. 1, pp. 19-20, 1 fig. London, January, 1920.

The author gives a systematic description of a new species and genus of aphis named *Neophyllaphis podocarpi*, and found on the leaves of *Podocarpus macrophylla* at Meguro (Tokyo). The winged and wingless forms both appear from May onwards in the second and following generations. The sexuparous forms are wingless, but it is interesting to note that the oviparous female and the male as well are winged ; these forms appear in September.

As is often found with species of *Siphonophorina*, the wingless viviparous females may produce either winged or wingless forms, but the winged females only produce apterous forms.

The new genus is closely related to *Phyllaphis* Koch., but differs from it in several characters.

608 - ***Cheimatobia brumata*, a Macrolepidopteron Injurious to Cherry Trees in the Rhone Valley, France.** — BLANCHARD, E., in *La Vie agricole et rurale*, Year IX, Vol. XVI, No. 10, p. 169. Paris, March 6, 1920.

The winter moth, *Cheimatobia brumata*, has been a pest for some years in the Rhone valley, especially in the north of Ardeche and the Loire department. The invasion has gradually spread up the Rhone valley and has been found at certain places in the Roanne district.

Orchards of cherry trees have suffered most. In the Rhone valley, some were found whose foliage had been entirely scorched, and the crop was consequently much reduced.

The author has tried to find out a method of control, complementary to that which consists in the use of bird-lime. The transformation into the perfect insect takes place in the soil, but at a depth that it is difficult to estimate on account of the vegetable remains that cover the soil. In 1916, the author injected carbon disulphide into the ground around some isolated trees which had been heavily attacked by the pest during the previous year. The injection was at the rate of some 600 kg. per hectare and was used at distances 50 cm. apart in every direction. Satisfactory results were obtained, as the number of female moths caught on the bird-lime was much smaller than on trees around which no carbon disulphide had been injected. However, the moth attacked the treated trees in spring, which showed that the treatment was not sufficient. Therefore, some more efficacious method should be sought, and the injections of carbon disulphide should be made closer together than they were in 1916.

The pest climbs the tree when the first cold weather arrives, a period which varies from one year to another.

609 – **Insects Injurious to the Almond Tree in Palestine.** — BLAIR, K. G., in *The Entomologists' Monthly Magazine*, Series 3, Vol. VI (Vol. LVI), No. 61 (N. 668), p. 13. London, January, 1920.

Mr. G. GARB of New York, who has recently travelleed through Palestine, sent to the British Museum (Natural History), for identification, three species of insects which he stated caused serious damage to almonds growing in Palestine.

Two of the insects received were wood or bark-boring beetles : *Capnodis carbonaria* Klug (fam. Buprestidae) and *Eccoptogaster* (*Scolytus*) *amygdali* Guér. (fam. Scolytidae) ; the third is the aphid *Tuberodryobius persicae* Cholodk.

It appears that *Capnodis carbonaria* has not previously been recorded as injurious to the almond tree. The specimens in question were taken from trees in the Gderah colony, south of Jaffa (Palestine), on July 10, 1919. Fullgrown or nearly full grown larvae were found boring galleries between the bark and the wood in the subterranean part of the trunk and roots. The larvae pupate inside the galleries they have bored. The insect has also been found in other localities, particularly in the colonies of Ekron, Beer-Jacob, and Pishon, and it is assuming great economic importance in connection with almond growing in Palestine.

Capnodis cariosa and *C. tenebrionis* L. have been recorded in Dalmatia as injurious to plum and cherry trees, to which they cause harm similar to that done to the almond tree by *C. carbonaria*.

A note appended to the present paper states that Mr. J. J. WALKER has often found two or three species of *Capnodis* — amongst which *C. tenebrionis* is the commonest — on the trunks of old apricot and other fruit trees at Salonika, in Besica bay, and in other regions in the eastern Mediterranean. These species, with *Chalcophora stigmatica* Dalm., had evidently developed in the trees, which had already been attacked by their larvae.

610 – ***Phryneta spinator*, a Beetle Injurious to Fruit Trees and Other Plants in South Africa.** — GUNN, D., in *The Agricultural Journal of South Africa*, Vol. X, No. 58, pp. 11 25, 14 figs. Johannesburg, 1919.

Morphological and biological description of *Phryneta spinator* F., more or less common in the Union and also known in Rhodesia, British East Africa, Nyassaland, and the Belgian Congo.

The larva damages fig trees and willows most, by hollowing out, in the lower part of the trunk and sometimes in the roots, numerous galleries which hinder the growth of the tree, cause a decreased yield in the case of the fig tree, and make the plant less resistant to mechanical strain. When the attacks are repeated and serious the tree usually dies. It sometimes happens that the beetle lays its eggs in peach and pear trees situated near infested fig and willow trees.

The adult insect does considerable harm by eating the bark of many plants : — Willow, fig, apple, apricot, peach, nectarine, pear, plum, vine, *Melia Azederach*, *Cupressus lusitanica* and *C. horizontalis*.

Nothing is known concerning the existence of natural parasites of the

eggs and larvae of *Phr. spinator*. Imagines collected on fig and willow trees have been found to be attacked by *Isaria* sp., but it seems that this fungus is not to be counted on as an efficient means for controlling the perfect insect.

In the case of the fig tree, the larvae hidden in the easily recognisable galleries in the trunk can be killed with the drawn-out tip of a knife or a strong, flexible wire; if the larvae are hidden deep in the roots and thus out of reach of a wire, a little paraffin or carbon disulphide should be injected into the gallery, which should then be stopped up.

After the larvae in the galleries are destroyed in this way, it is advisable to prevent deposition of further eggs, to protect the trunk in October (the adults begin to appear in November) by means of close-meshed wire gauze, the two ends of which are tied close together with strong string, but taking care that the part where the gauze is tied is sufficiently far from the trunk to prevent the insect from laying its eggs on the bark through the meshes.

Bands made of paper covered with tar or carbolineum, as well as painting the trunk with these two substances are not to be recommended as they injure bark of the fig tree. Spraying the trunk with insecticides is also inefficacious.

The fig tree should be cultivated in such a way as to have a single trunk, so that the cluster shape or the presence of several stems on one tree should be avoided. The growth of weeds during summer should be prevented a they provide shelter for the beetle and make it difficult to see where the eggs have been laid on the bark. The growth of fig trees near willows should be avoided also, because the willow is the chief food of this cerambycid.

Fig and willow trees that are severely attacked by the beetle and, for this reason, of no further utility, should be removed and carefully and completely destroyed.

611 – **The Orange Fly (*Ceratitis capitata*), Injurious to Peaches in Madagascar.** — LEGENDRE, I., in the *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXIII, No. 1, pp. 8-9. Paris, 1920.

As a complement to the information published in 1915 (1), the author now communicates the fact that, in December, 1917, and January-February, 1918, he has again observed the presence of *Ceratitis capitata*, widely distributed in the neighbourhood of Tananarive (Madagascar), where it injures peach trees.

Peaches produced by trees from the Cape, gathered towards the end of December, 1917, before completely ripe, apparently healthy, and kept, in the laboratory, showed after a few days the presence of *Ceratitis* larvae in their pulp, in which the pest produced the usual alterations.

(1) See *R.*, June, 1915, No. 670. (*Ed.*)

ALFREDO RUGGERI, *gerente responsabile.*

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

612 – **Protein Requirement of Maintenance in Man and the Nutritive Efficiency of Bread Protein.** — SHERMAN, H. C., with the Co-operation of GILLET, L. H. and OSTERBERG, E. (Department of Chemistry, Columbia University, New York), in *The Journal of Biological Chemistry*, Vol. XLI, No. 1, pp. 97-109. Baltimore, M. D., Jan., 1920. RURAL HYGIENE

A report of the net results of earlier experiments upon the protein requirement in the maintenance metabolism of man which were suitable for direct quantitative comparison, together with the data of the authors' own experiments upon a dietary in which nearly all the nitrogen was taken in the form of wheat bread.

Probably the best indication of the normal protein or nitrogen requirement can be obtained by averaging the observed nitrogen output in all available experiments in which the intake appears to have been barely sufficient or not quite sufficient to balance intake with output. Since, however, the protein minimum thus determined is influenced by the action of carbohydrates in economising protein and fats (1), the results will be comparable and will bear directly upon the practical problems of protein requirement in food economics, but only in those cases in which the energy value of the experimental ration is at least approximately adjusted to the energy requirement of the subject. In order to minimise the personal equation in the interpretation of the work of others, the authors' uniformly excluded all experiments showing a loss of body nitrogen greater than 1 gm. per day. The general average of the 109 experiments that remained shows an indicated requirement of 0.635 gm. of protein per kg.

(1) See *R.* No. 1918, Nol 1195 and 1196; *R.* April, 1920, No. 380. (*Ed.*)

of body weight, or 44.4 gm. per " average man " of 70 kg. per day. The minor differences between the sexes are 0.633 gm. per kg. with men, and 0.637 gm. per kg., with women and therefore can be neglected. Although this represents a large amount of work from numerous sources, so that errors due to individual peculiarities etc., are minimised, the data of individual experiments, however, are rather divergent. If the extremes are rejected, and attention is paid only to 94 or 76 experiments out of 109, the protein requirement becomes respectively 43 or 41 gm. per man of 70 kg. per day, compared with. 45 gm. for the 109. The more critical the selection included in the average, the lower the indicated protein requirement becomes. As a general average, it can be estimated at about 0.6 gm. per kg., or 42 gm. per 70 kg. per day.

The authors have previously shown that the protein of rations consisting essentially of maize or oatmeal supplemented only by small amounts of milk (the latter furnishing but 10 to 20 % of the food protein), may be fully as efficient in the maintenance metabolism of man as the average protein or ordinary mixed diets.

The authors give the data of a series of experiments (1) in which ordinary (white) wheat bread furnished over 95 % of the protein consumed, and which demonstrated : 1) That practical equilibrium was maintained on an intake of a little less than 0.5 gm. of protein per kg. of body weight per day ; 2) that the protein of wheat bread showed as high an efficiency in maintenance as would be expected of the protein of mixed diet in general. This result is in accordance with the findings of HINDHEDE and of MORGAN and HINTZE and also of OSBORNE and MENDEL and of Mc COLLUM and his associates, that the wheat protein that suffices to maintain body weight in adult rats is about 5 to 6 % of the total calories of the food consumed. Thus, as there is an average requirement of about 0.6 gm. of protein per kg. of body weight per day, this corresponds to 2.4 protein calories, or 6 % of the 40 calories per kg. which is commonly accepted as a fair average energy requirement for moderately active people.

It appears that a standard allowance of 1 gm. of protein per kg. of body weight per day, supplemented by milk products, provides a margin of safety ; the latter should be more liberal in proportion for growing children and for pregnant or nursing mothers.

613 – **The Nutritive Value of Yeast Protein.** — OSBORNE, T. B. and MENDEL, L. B. with the Co-operation of FERRY, E. L. and WAKEMAN, A. J., in *The Journal of Biological Chemistry*, Vol. XXXVIII, No. 2, pp. 223-227 + 1 Chart. Baltimore M. D., June, 1919.

The idea of using yeast as a source of food protein for man and the higher animals is not new, although it has been given renewed emphasis through the war. It also presents the possibility of a synthetic production of protein from exceptionally simple compounds, and in addition, its use

(1) SHERMAN, H. C. and WINTERS, J. C., *Journal of Biological Chemistry*, Vol. XXXV, p. 307, 1918 : SHERMAN H. C., WINTERS J. C. and PHILLIPS V., *Ibid.*, Vol. XXXIX, No. 1, p. 53, 1919.

in supplying water-soluble vitamine was recently demonstrated (*Journal of Biological Chemistry*, Vol. XXXI, p. 149, 1917; *American Journal of Physiology*, Vol. XLV, p. 431, 1918). Although the statements on this point are not in uniform agreement, it has repeatedly been found that in the case of both adult men and animals, the utilisation of the nitrogenous components of yeast, as judged by the coefficient of digestibility and by the nitrogen balance is good. Feeding experiments with growing animals with the most exacting requirements for physiologically adequate protein are particularly useful for determining the utility nitrogenous nutrients. Apparently, there are no records of prolonged growth when yeast was the sole source of protein. Owing to this the authors kept rats for more than a year upon a diet in which yeast was the sole source of nitrogen as well as water-soluble vitamine. The results showed a nitrogen utilisation in several cases of 74 to 83 %. The fact that animals can tolerate such large quantities of a food product so unique as yeast, obviously indicates that toxic substances must be excluded. In other experiments in which yeast was used solely as a source of water-soluble vitamine, the animals grew vigorously to adult size, but were sterile, with a very few exceptions, as the testes showed an absence of germ cells.

Other investigators have described similar conditions among animals fed on diets deficient in water-soluble vitamine.

614 – **Maintenance and Production Value of some Protein Mixtures.** — HART, E. B. and STEENBOCK, H. with the Co-operation of LETCHER, F. in *The Journal of Biological Chemistry*, Vol. XXXVIII, No. 2, pp. 267-285 + Charts 3. Baltimore, M. D., June, 1919.

The efficiency for growth of a protein mixture depends upon the qualitative and quantitative composition of its amino-acid content. The supplementing effect of specific amino-acids for certain definite proteins has been especially studied by OSBORNE and MENDEL, but up to the present time very little data have been accumulated on the efficiency for growth of practical protein mixtures in common use, both in human and in animal nutrition. MCCOLLUM has shown the relatively low efficiency for growth of the cereal grain proteins when fed alone or in mixtures, and a much higher utilisation of casein and milk proteins. HART and HUMPHREY demonstrated that there is considerable variation in the utilisation of protein mixtures from plant sources for milk production. These studies have a decided practical bearing, as they show how a greater utilisation of a poor protein mixture can be obtained by adding some single protein, or a mixture of several with the proper supplementing qualities.

At the present time definite knowledge is needed as to what products and in what amounts efficient supplementary effects be secured to obtain the maximum utilisation of the cereal proteins. Bearing this in mind, the authors carried out experiments with pigs. The results, which are shown in charts, contain the following facts of practical importance :—

Cereal grain proteins of low production value are not appreciably increased in efficiency by supplementing with a maize kernel protein concentrate, such as gluten feed, or by a legume roughage, such as alfalfa ; even the

proteins of flaxseed meal (oilmeal) when constituting 50 % of the ration did not increase the efficiency of those of the maize kernel, but when they constituted 20 to 25 % of the ration, there was an evident increase.

The effective supplementing of cereal proteins, cereal proteins + alfalfa proteins, or cereal proteins + cabbage and potato proteins, was accomplished by additions of either milk or whey, or meat or fish proteins. The two former were the most effective. With but 16 % of nitrogen coming from the whey proteins, the efficiency of a maize + alfalfa + whey mixture was made nearly equal to that of a similar mixture in which 27 % of nitrogen came from skim-milk proteins in place of whey proteins.

The tankage proteins were not quite so effective in their supplementary relations as were those of milk ar whey.

The 18 % of nitrogen in a maize alfalfa tankage ration was practically as efficient as when 35 % nitrogen was supplied. It is to be expected that variations in the efficiency of the proteins of such commercial products as tankage, fish meal, meat scraps, etc., will occur, dependent upon what proportion of their total proteins is derived from the less active and incomplete albuminoid group, such as elastin, collagen, keratin, etc.

Meat crisps or fish meal fed with starch and serving as the sole source of nitrogen showed efficiencies of only 40 %, whilst milk proteins used under similar conditions showed a value of 60 %.

The protein mixture of maize and milk, or oats and milk, showed production values of 60 to 65 %, with approximately 25 % of the nitrogen derived from skim milk, whilst the efficiency of a maize and tankage protein mixture, or a barley tankage mixture was about 40 %. In the latter case approximately 30 % of the nitrogen was derived from tankage. It appears fairly certain that either milk or meat will supplement the proteins of the various cereal grains to approximately the same degree, i. e., tankage when used to supplement barley, oats, or maize, will yield a protein mixture of similar production value. In the same way, milk will supplement the various cereal grains, but in every case with more efficiency than tankage. This being granted, the choice of cereal grains for feeding animals depends entirely on their price when tankage or skim milk is added as a supplement.

Further experiments, which touch human as well as animal nutrition, indicated that a protein mixture drawn from 5 common sources, viz., rice, wheat, maize, potatoes, and cabbage showed a low value for growth when the protein level was brought to a basis comparable with the other experiments, i.e., 13.3 %, by the use of a protein concentrate such as wheat gluten. The production value of this mixture was 19.4 %. When the nitrogen of the wheat gluten was displaced by an equal amount of meat crisps nitrogen, the efficiency rose to 32.7 %, and when replaced by an equivalent in milk nitrogen it rose to 47 %. The efficiency of the latter mixture was not so high as a maize-grain-milk protein, mixture, due largely to the greater faecal losses involved in the mixed ration containing cabbage.

615 – **The Distribution of Water-Soluble Vitamine.** — OSBORNE, T. B. and MENDEL, L. B with the Co-operative of FERRY, E. L. and WAREMAN, A. J., in *The Journal of Biological Chemistry*, Vol. XXXIX. No. 1, pp. 29-34 + 2 Diagr. Baltimore, M D., August, 1919.

The water-soluble vitamine is widely distributed in ordinary food products and it is also present in cottonseed, millet seed, flaxseed, Kafir corn, hempseed, cabbage, alfalfa, clover, timothy, spinach, potato, carrot, and coconut meal. To this list the authors added the onion bulb, turnip root, the leaves, stem and roots of the beet, and the tomato fruit.

It is also important to know the comparative value of the different natural foods with regard to water-soluble vitamine and nutrition, and the authors have conducted experiments with this in view.

To permit more accurate comparisons of the water-soluble vitamine content of natural foods, the procedure adopted consisted in feeding each day small, known quantities of the vegetable product under investigation, apart from the basal ration which was fed *ad lib.* In this way the effects of the different food substances could be compared, based on the water-soluble vitamine content. It was found that the samples of clover, alfalfa, and timothy hays used to furnish the water-soluble vitamine were much less efficient than the dried immature specimens. The fact that this difference exists, may have importance in feeding young animals and dairy cows. Consequently the authors advise that hay made from immature clover or alfalfa be used to replace a part at least of the milk fed to young stock, whilst the hay ordinarily given to dairy cattle should be replaced by that from less mature plants.

616 – **Probable Relation between the Fat-soluble Vitamine and the Yellow Plant Pigment.** — I. STEENBOCK, G., White Corn versus Yellow Corn and a Probable Relation between the Fat-soluble Vitamine and Yellow Plant Pigment, in *Science*, Vol. I,, No. 1293, pp. 352-353. Philadelphia, Oct. 10, 1919. — II. STEENBOCK, H. and BOUTWELL, P. W., with the Co-operation of GROSS, E. G., and SELL, M. T., Fat-soluble Vitamine, the Comparative Nutritive Value of White and Yellow Maize, in *The Journal of Biological Chemistry*, Vol. XLI, No. 1, pp. 81-96. Diagr. 7, Figs. 2. Baltimore, M. D., Jan., 1920.

The distribution of fat-soluble vitamine in various roots was investigated by STEENBOCK, at the University of Wisconsin, M. dison who concluded that, whilst coloured roots (carrots and sweet potatoes) are rich in this vitamine, the white roots (sugar-beets, mangels, dasheens and Irish potatoes) contain a negligible quantity or none at all. It is the same with the maize. The yellow maize has, all things being equal, a much higher efficiency in assisting in the development of young stock thus fed, than the white grain. Red maize, with a white endosperm free from yellow pigment, gave, in experiments with rats, the same result as white maize, although somewhat inferior. A variegated maize with white, yellow, red and blue grain resulting from the predominance of yellow and red) gave results intermediate between those obtained with yellow and white maize.

There have also been other cases of possible correlation between the simultaneous occurrence of yellow pigment and fat-soluble vitamine. OSBORNE and MENDEL found that whilst the yellow petroleum oils contain

this vitamine, it is lacking in beef suet. Further, butter fat may be divided into 2 parts : One without colour and without vitamine, and one a yellow liquid containing vitamine. STEENBOCK and his collaborators have verified the fact that in the series of petroleum oils, the vitamine content is rather greater when the yellow pigment is more intense. Consequently, the vitamine ought to be found where the yellow pigment itself, or a compound in close relationship with it, is present. If heated, butter loses the vitamine, and at the same time, becomes decolorised.

617 – **Behaviour of *Bacterium coli* in Milk.** — GORINI, C., in *Atti della Reale Accademia dei Lincei* Serie Quinta, Rendiconti, classe di Scienze fisiche, matematiche e naturali, Vol. XXIX, Pt. 3, pp. 114-118. Rome, Feb. 1, 1920.

The biochemestry of *Bacterium coli* is a subject of much discussion, and one of the most debated points is its behaviour in milk. The author studied this question in the Bacteriological Laboratory of the Royal School of Agriculture, Milan, and has obtained results which led him to the following conclusions :

Bacillus coli develops differently in milk cultures according to its acidifying power. That is why it is possible to classify them into two types ; 1) Power ful acidifiers which cause coagulation even when the milk has undergone, owing to sterilisation such changes as to acquire a brownish tint ; 2) weaker acidifiers, which by means of its rennet enzyme, only cause coagulation when the milk has been so treated during sterilisation as to preserve its white colour. The best way would be, if possible, to have milk produced antiseptically, so that any far-reaching process of sterilisation would not be necessary.

The distribution of the two types of coli in the various media show the vigorous type more frequently in forage and the weaker type in the excrements of man and cattle. In milk, the proportion varies owing to the double means of contamination through excrement and forage.

The general conclusion from these observations is that the diagnostic value of the coagulating power of coli becomes augmented, and several differences of opinion on this subject, especially with regard to the hygiene of water, can be smoothed over.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY

618 – **Effect of Frost on Maize on the Tablelands in New South Wales, Australia.** — WENHOLZ, H., in *The Agricultural Gazette of New South Wales*, Vol. XXX, No. 7, pp. 509-511. Sydney, July, 1919.

On the tablelands in New South Wales, frost is one of the meteorological factors most harmful to maize, and considerably shortens the growing season, exposing late varieties which have not yet reached maturity, to injury from heavy frosts.

The season without frost is limited by the late spring frosts on the one hand, and by the early autumn frosts on the other. The latter have the more marked influence for the following reasons :

(1) The plant in the first stages of development is much less sensitive to the affect of low temperatures than in the cobbing stage when the turgid tissues contain a large percentage of water (very diluted cell sap).

(2) In the spring some varieties are comparatively resistant to cold, whilst in the autumn, during the stages of earing and cobbing, all the varieties, without exception, are unable to withstand very low temperatures.

(3) Several varieties of maize, even if injured by the spring frosts, are capable of developing fresh suckers, which grow normally and replace the dead main stem.

(4) If total permanent injury is caused, replanting is always possible.

For these reasons, the following recommendations may be made:

(1) Very early varieties should be chosen, such as Early Canada and Gehu (flint varieties,) Minnesota 23, Golden Glow, North-Western Dent and Silver King (dent varieties).

(2) Acclimatised seed should be used and rigorous selection for early maturity varieties should be carried out.

(3) Sow as early as possible.

(4) Sow thinly to encourage stooling.

(5) Hasten maturity by applying superphosphate at sowing time (an advance of 15 days is obtained.)

(6) Avoid the use of very large amounts of soluble nitrogenous fertilisers (ammonium sulphate and sodium nitrate) which tend to delay maturity.

619 – **Relation of the Moisture Equivalent of Soils to the Moisture Properties under Field Conditions of Irrigation.** — HARDING, S. T., (Irrigation and Hydraulic Engineer, Berkeley, California) in *Soil Science*, Vol. VIII, No. 4, pp. 303-312, Figs 5. Baltimore, 1919.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

In studies of the water requirement of soils under irrigation, or to be irrigated, some criterion which will furnish an index of the soil moisture properties is needed. This index can be expressed in a moisture equivalent (1); the comparison of this equivalent with other soil properties has usually only been made under laboratory conditions. The author reports on investigations dealing with the critical moisture points of soils, under the actual field conditions of irrigation practice.

The data given were secured from a wide range of soils, and include more than 9150 individual moisture determinations. The results discussed covered a total of 136 determinations of moisture equivalents varying in numerical value from 4.1 to 37.6, and made in various parts of the Eastern United States from 1913 to 1918. Comparisons of moisture conditions were made both for the surface foot of soil and for the average of the upper 5 feet, between the maximum field capacity applied to soils shortly after irrigation, the normal field capacity at from 1 to 3 days after irrigation, and the usual moisture before irrigation and the wilting of the crop.

(1) See *R.*, 1919, No. 422, Note. (*Ed.*)

This comparison shows that there is a fairly constant, relationship between the moisture equivalent and the various moisture properties of soils, which appears to offer promise of utility in determining moisture properties and probable irrigation practice of soils, where irrigation is contemplated, particularly as regards the depth of water retained after irrigation, with its effect on the depth to be applied and the necessary frequency of application. However, although the data presented indicate the nature of the relationship between the different properties studied, they are not sufficient to fix the numerical values except in a very general way. It appears that the relationship is not a linear one, that is, measured in one dimension only, except in the case of the wilting coefficient (1); under normal field conditions, this last relationship would have been lower compared with that based on experiments with limited volumes of soil.

The maximum depth of water per foot depth of soil, retained for the upper 5 feet of soil was about 1.25 inches, which indicated that depths of single irrigation in excess of 6 to 8 inches, even under favourable soil conditions, will not be retained in the upper 5 or 6 ft. of soil. This conclusion is in accord with the results of general field observations from many sources (2).

620 – **Cause of the Unproductivity of "Raw" Subsoils in Humid Regions.** — McMiller, P. R. (Agricultural Experiment Station, University of Minnesota), in *Soil Science*, Vol. VII, No. 3, pp. 233-236, bibliogr. of 4 works. Baltimore, March, 1919.

Harmer has previously shown that certain subsoils, even when inoculated, are less productive than others with regard to alfalfa (3).

The results of vegetative experiments carried out by the author with soils similar to those employed by Harmer, show that an application of potassium sulphate and disodium phosphate, removes the "rawness" of the above-mentioned subsoils, and renders them equally productive towards alfalfa as the corresponding surface soils. This proves that "rawness" in these cases is due to lack of readily available mineral nutrients.

621 – **Potassium-Bearing Minerals as a Source of Potassium for Plant Growth.** — De Turk, E. (University of Illinois), in *Soil Science*, Vol. VIII, No. 4, pp. 269-301, Tables 12, Bibliogr. of 69 works. Baltimore, Oct., 1919.

The earth's crust, to a depth of 10 miles has been estimated to contain an average of 2.32 % of potassium; more recent calculations place the estimate at 2.46 %, which indicates that the problem of potassium for agriculture is one of liberation rather than of supply for normal agricultural soils and the common farm crops.

After a review of previous investigations connected with this subject, the author passes on to his own researches which included 4 experiments carried out for the purpose of obtaining information on the following questions; *a*) Will applications of primary potassic minerals to peat soil affect

(1) See *R.* 1912, No. 903. (*Ed.*)

(2) See Mosier J. G. and Gustavson, A. F., *Soil Physics and Management.* Philadelphia, 1917. (*Ed.*)

(3) See *R.*, 1919, No. 162. (*Ed.*)

the yield of crops grown therein ? *b*) To what extent can crops utilise the potassium in those minerals ? *c*) Is the availability of the mineral potassium for plants affected by the presence of actively decomposing organic matter or of magnesium or sodium chlorides ? *d*) What are the effects of the above-mentioned decomposing matter upon the amount of potassium which can be extracted by water from these minerals under soil conditions ? *e*) What effect does decomposing organic matter have upon the solubility of the mineral potash in the absence of soil ? *f*) What is the explanation of the low availability of the potassium of dune sand ?

The author employed in these researches minerals containing the following amounts of total potassiun : Orthoclase 11 %, microcline 11.23 %, leucite 9.49 %, alunite 8.32 %, ignited alunite 13,72 %, lepidolite (1) 8.99 %, limestone 0.21 %, and calcium carbonate 92 % (approximately). The organic materials used were : Clean, finely ground, alfalfa hay, and prairie hay, fresh cow manure without litter, dried at low temperature and ground ; and the same without drying ; pure chemicals were also used. Buckwheat was employed for the pot cultures.

Results showed that finely ground potassic minerals increased the yield of buckwheat in peat soil by 21 to 34.8 % ; but lepidolite was detrimental, expecially if present in large amounts. These results should, however, be confirmed by further experiments and with other cultivated plants. The addition of crop residues, manure, soluble sodium or magnesium salts to peat soil together with the minerals used in this experiment, did not increase the crop yield or the availability of the mineral potash. The so-called " feeding power " of the plant itself, through the activities of the roots system, is an important factor in the utilisation of relatively insoluble potash.

The solubility of the minerals used, as determined by extraction with water, was very low, except in the case of lepidolite, but this was increased by ammonium chloride, and by decomposing alfalfa. The result in the latter case may be due to ammonification of the nitrogenous compounds in the alfalfa. All the minerals used can absorb considerable amounts of potash in solution ; this absorption is probably physical to a large extent.

The low availability of the potash of dunesand was due to the fact that most of the potash was contained in the larger particles, whose relatively small surface is sufficient to explain the low solubility of the potash, however, the increase in solubility of the potash in such sands was not sufficient to be of practical value.

622 – **The Relation between Certain Acidic and Basic Constituents of the Soil as affected by Ammonium Sulphate and Nitrate of Soda.** — Howard, L. P. (Rhode Island Agricultural Experiment Station), in *Soil Science*. Vol. VIII, No. 4, pp. 313-321, bibliogr. of 12 works. Baltimore, Oct., 1919.

From investigations made with soils manured with ammonium sulphate and nitrate of soda, respectively, during the past 25 years, the author draws certain conclusions concerning the well-known fact that the former

(4) A mica containing lithium and potassium. (*Ed.*)

produces an acid condition in the soil, whereas the latter tends to produce an alkaline reaction. He believes that soil acidity is comparable to the condition of acidosis in the animal organism, and reflects a change in the position of equilibrium between acids and bases, the soil being considered as a mixture in part, of more or less inactive basic and acid constituents.

In the soils under observation, the lime requirement, the exchange of bases by extraction with a normal solution of potassium chloride, the extraction with 2/N hydrochloric acid, the ammonia extract, an the hydrogen-ion concentration were determined The results of the whole series of observations indicated that soil acidity caused by long-continued use of ammonium sulphate is due to a change in the ratio of bases to acids. The position normally occupied by the stronger bases such as calcium and magnesium is taken by weaker bases such as iron and alumium. The neutrality of the soil solution can no longer be maintained, since salts of these weak bases dissociate, and the resulting free acid is accompanied by a definite concentration of hydrogen ions.

623 – **Influence of Mines upon Land and Livestock in Cardiganshire, Wales.** — Griffith, J. J. (Agricultural Department, University College Aberystwith), in *The Journal of Agricultural Science*, Vol IX, Pt. 4, pp. 366-395, pl. 16. Cambridge, 1919.

In North Cardiganshire there is an area of 3000 acres of good land that has become unproductive and deleterious to stock owing to contamination from lead mines in the neighbourhood, caused either by surface drainage water from the débris, by sand blown from the heaps by the dry east winds., by the use of mine waste for making and repairing roadways, by contaminated water running out of mine levels, or by actual contact with the animals themselves. Whatever the exact cause, the unproductiveness of the affected land is due to the presence in the soil of toxic substances mainly lead and zinc, and, in some cases, copper, iron pyrites and marcasite. The list of minerals classified according to relative abundance causing injurious effects is given as follows : Galena, cerussite, pyromorphite (lead minerals); blende, hemimorphite or Smithsonite, calamine (zinc minerals) ; iron pyrites and marcasite (iron sulphides) ; copper pyrites, malachite, azurite (copper minerals); manganite (hydrated oxide of manganese) ; and siderite (carbonate of iron). Unfavourable changes may arise in the mechanical composition of the soil, leading to deterioration of its physical properties such as its capacity to retain water.

The deleterious effects are much more pronounced upon some crops than others. Leguminous plants, for example, appear to be the most susceptible. Lead and zinc are carried on to the soil in the form of galena and blende respectively, *i. e.*, as sulphides that are soon acted upon in the soil, and converted into other compounds. It appears probable that the lead is in some measure retained by the humic or other colloidal substances of the soil, and enters into the composition of the plant, but only in very minute quantities. The poisoning of animals may be attributed more to the lead deposited on the exterior of the plants rather than to that contained internally.

The application of sodium silicate to the soil tends to mitigate the undesirable influences of mine refuse upon plant growth ; but the most effective remedial measure is the application of a heavy dressing of lime considerably greater than the lime requirement, as determined by the absorption of lime from calcium bicarbonate solution. Apart from liming it is by preventive rather than remedial measures that the losses of both land and livestock may best be minimised and this should involve : Careful management of active mines, to reduce as far as possible the amount of injurious ingredients allowed to flow into rivers ; the guarding against pollution from disused levels ; the protection of mine slime and sand heaps at both active and disused mines so as to prevent the material from being washed into the water courses ; due attention paid to the construction and care of river and leat embankments ; selection of stock the least susceptible to lead poisoning for grazing affected pastures which should be worked alternately with unaffected land ; allowing the washing of pastures by rain after floods before further grazing ; fencing off the very worst of the poisoned land ; threshing contaminated hay before it is supplied to the animals ; the strict avoidance of utilising mine wastes for any purpose whatever that may lead to injury to land or stock.

The effects on oats, clover and mustard were determined by experiments in pots, and these were confirmed by limited additional experiments carried out in the field.

PERMANENT IMPROVEMENTS, DRAINAGE AND IRRIGATION

24 – **The Use of Alkali Water for Irrigation.** — HARRIS, F. S. and BUTT, N. I., in *Utah Agricultural College Experiment Station, Bulletin* No. 169, pp. 1-41, Bibliogr. of 54 works. Logan, Utah, July., 1919.

A survey of the literature dealing with this subject demonstrates that although some observations have been made on the action of water containing alkali on the soil and plants, i. e., water with excessive quantities of soluble salts, practically no systematic experiments have been conducted to determine plant tolerance of such water. Most of the field observations admit error in interpreting the effect, owing to complicating factors, such as the original salt content of the soil, the accumulation of salts in the upper strata and the action of various non-alkaline salts. To study the effect of the alkali salts when present alone in the water, an experiment was begun at the Utah Experiment Station in 1915, to determine the concentration of various salts necessary to make water unsuitable for irrigation in loam and sandy soils. Pots containing an equivalent of 7.24 kg., of dry loam soil and others with 7.69 kg., of dry sand, were used. Throughout the experiment, moisture was maintained at 20 % of the dry weight of soil, by the addition of adequate solutions. In each pot, 30 kernels of New Zealand wheat were planted with a final reduction to 20. The pots were then sealed with paraffined paper to minimise evaporation and, consequently, the concentration of the salts at the surface. The following solutions were used: Sodium chloride and sodium carbonate, ranging from 500 to 4000 parts per million ; sodium sulphate from 1000 to 14 000 parts per million, and equal quantities of each of these salts from 1 000 to

10 000 parts per million. The soil in the pots was moved and mixed each year, the experiment covering a period of 4 years, until 1918.

So many factors enter into the toxicity of alkali (the nature of the soil, drainage, amount of water necessary for irrigation, soil moisture, methods of handling the soil, etc.), that it is impossible to give definit limits of salinity in irrigation water. However, in the experiments reported, the dry matter produced, the height of plants, the number and weight of leaves, the number and length of culms, the number of ears and spikelets, the turgidity of the plants, and the general appearance of the crops, were all found useful indications of the effect of alkali water.

Results in different soils, showed that wheat cannot be irrigated with water containing 1000 parts per million of sodium carbonate, and that even 500 parts per million will, in a short time reduce the growth of the crop. On the other hand, more than 1000 parts per million of sodium chloride, and more than 4000 parts per million of sodium sulphate proved to be harmful after 2 or 3 years. A mixture of the three salts, although not so toxic as the most injurious of the salts, was more harmful than the less toxic ones. More than 4000 parts per million should be considered as dangerous. The authors also conducted laboratory experiments during the winter of 1918-1919 with 20 groups of loam soil, each of which contained 66 tumblers ; to each group, combination solutions of sodium chloride sodium carbonate and sodium sulphate were applied in proportions varying from 1 to 9. The concentration of the different solutions ranged from 0.062 to 1.25 gram-molecules per litre.

In this experiment, the first definite toxic effect was with a molecular strength of 0.3125 and became more marked with a molecular strength of 0.5.

MANURES AND MANURING

625 – **The Carbonification of Burnt Lime in Soils.** — MacIntire, W. H. (University of Tennessee Agricultural Experiment Station) in *Soil Science*, Vol. VII, No. 5, pp. 325-44. Fig. 1, Pl. 4, Bibliogr. of 73 works. Baltimore, May, 1919.

The practical and economic importance of liming is more and more evident, and the development of modern crushing machinery has favoured the use of ground limestone as well as of burnt lime. The following question has therefore to be considered : — Which of these two types is scientifically and economically most advantageous ? The application of either burnt air-slaked or water-slaked lime is followed by the phenomena of absorption and carbonification, changes whose order depends on existing soil moisture conditions and the manner of application. If the application is in excess of the immediate absorption coefficient, calcium carbonate will be formed from the unabsorbed lime, followed by the slow decomposition of the carbonate and, finally, an absorption of lime by the soil which differs from the initial rapid absorption and may continue over a period of years. A quantitative comparison between the activity of burnt lime and natural limestone in soils can, therefore, be based upon periodic determinations of the calcium carbonate, which shows the need for a careful study of the carbonification of lime in soil. The author has examined this question both in the field and in the laboratory.

Neither dry calcium oxide, nor dry calcium hydrate react with carbon dioxide, but a slight film of moisture is sufficient to initiate the carbonate reaction. Small amounts of calcium oxide exposed to normal humidity reverted to the carbonate more rapidly than if obtained by slaking.

The formation of carbonate from calcium hydrate is controlled by the amount of free water available to convert the hydrate from solid to solution phase. The carbonification of the burnt lime must be preceded by hydration and dissolving, but, when moist carbon dioxide is present, the reactions, are so rapid as to be practically simultaneous. A protecting film, of calcium carbonate around the nuclei of hydrate is liable to be formed, which retards further carbonification due to exposure to the air.

Pot and field experiments showed that the lime carbonated more rapidly when applied on the surface of the soil, than when dug in either as dry mulch or in damp soil; a sandy compost applied to the surface soil tends to retard carbonification. After the application of 2 tons per acre of burnt lime and the admixture with the upper 6 inches of a soil 8 in., deep, the maximum carbonification ensued within 5 days, and complete absorption occurred within 10 days. The time taken to attain this maximum was not influenced by the 90 tons of supplementary dry manure.

When the applications were larger (8 tons per acre) the maximum carbonification (96 % theoretically) of the unabsorbed residues was completed after 19-38 days. The supplementary dry manure treatment caused no determinable change during thus period. Whilst carbonification was more rapid with light or medium application of lime, with heavy applications of 32 tons per acre, however, it took place more gradually; it reached about 80 % of the theoretical amount for the lighter quantity and 50 % for the heavier at the end of the second year of exposure, after which there was but little change.

The losses of total calcium salts from the several carbonate checks were practically independent of the extent of treatment; whereas the losses from the burnt lime increased according to the amount of treatment. In the case of soil *in situ*, the subsoil considerably obviates these losses.

The comparison between a clay loam and a silt loam showed that the addition of water to the former caused more rapid and greater carbonification either with surface application or with lime dug in but this was not the case with the silt loam.

The result of practical experiments under different conditions demonstrates that although the carbon dioxide utilised in carbonification is partly due to the soil atmosphere, it is derived in the main from that furnished by the aerial atmosphere. The open sandy types effected a more extensive carbonification than the heavier types even if these were rich in organic matter. This was probably due to a smaller absorption of lime by the sandy types of soil.

Finally, the following facts are interesting from a practical standpoint: The burnt or slaked lime in 2-4 ton application per acre, reverts to the carbonate more rapidly when left on the soil surface than when mixed with a dry mulch or the moist soil; carbonification is much more

rapid in humid atmospheric conditions. If the oxide or hydrate application is left on the surface for several days prior to working in, the treatment is, in effect, an application of finely divided calcium carbonate. If, on the contrary, the oxide or hydrate is incorporated within the upper zone of the soil, prior to a more thorough distribution, the concentration thus effected will bring about in the treated zone, a temporary and partial sterilisation which may have beneficial results. The first action of burnt lime applied to soil is to fix atmospheric or soil moisture, and once this is accomplished, there is no tendency to effect any chemical disintegration of soil organic matter. Neither the burnt lime nor the slaked lime, in the quantities ordinarily employed can be considered as chemically destructive of soil organic matter when used in the manner considered advisable in ordinary applications either on the surface or worked into the soil.

626 – **Carbonication or Manuring with Carbon Dioxide.** — I. GERLACH (Landw. Institute der Kaiser Wilhelm-Gesellschaft in Bromberg), Kohlensäuredüngung, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXXIV, No. 6, pp. 77-82. Berlin, 1919. — II. RIEDEL, F., Die Anwendung der Kohlensäuredüngung in grossen. *Ibid.*, Nos. 32-34-35, pp. 429, 451-455, 467-469, Figs. 6. — III. IBID, in *Tonindustrie Zeitung*, Year XLIII pp. 607-619. Berlin, 1919. — IV. IBID, Die Ausnutzung der Kochofenabgase zur Kohlensäuredüngung, in *Stahl und Eisen*, Year XXXIX, pp. 1497-1506. Essen a. d. Ruhr, 1919. — V. IBID, Verfahren und Einrichtung zur Ausnutzung Kohlensäurehaltiger, unreiner Gase oder Abgase. (D. R. P. 316637, Kl. 806), in *Chemisches Zentralblatt*, Vol. I-II, No. 8, Techn. Teil., p. 334. Berlin, 1920. — VI. GEHRING, A., Düngung mit Kohlensäure, in *Umschau*, Year XXXIII, pp. 809-813, Berlin, 1919. — VII. BLOCK, B., Die Verwendung der Kalkofengase zur Kohlensäuredüngung, in *Deutsche Zuckerindustrie*, Year XCIV, pp. 399-401. Berlin, 1919.

I. — FISCHER R. (*Gartenflora* pp. 298-1912) and others have previously demonstrated the possibility of increasing the yelds of crops by augmenting the amount of carbon dioxide in the air. GERLACH, resuming these experiments at the Agricultural Institute at Bromberg, obtained on an average, in 1918 the following results (p. 697, Table I), comparing crops in open field with crops in glass cases in small greenhouses with or without the introduction of carbon dioxide.

The extra yield in the open field may be attributed to cloudy weather, but the data for the lettuce are not reliable, as there was only a single plant in each pot. Nevertheless, according to these experiments, a positive action of carbonication cannot be denied, but GERLACH asks if the results are sufficiently important to justify practical use without first waiting for further confirmation by later experiments.

II-VII. — Besides this, RIEDEL observed that out of 100 parts of organic plant tissue one-half is composed of carbon, in this way :

Although up till 1860, it was believed *ab antiquo* that plants were able to feed themselves organically, that is to say on carbon from the soil humus, LIEBIGS' theory of carbon dioxide assimilation from the atmosphere was accepted, without however attributing any importance to the fact that the air contains barely 0.3 % of carbon dioxide and that the marked development of vegetation in the carboniferous period, which led to the

Percentage of dry matter of crops grown in open and also from plants grown under cover with addition of carbon dioxide.

Crops	In open field	Under cover + CO^2
Oats	+ 8 %	+ 15 a 20 %
White Mustard	+ 11	+ 18
Carrots	+ 25	— 4
Runner Beans	+ 60	+ 6
Blue Lupin	+ 35	+ 14
Tagetes	+ 19	+ 31
Phlox	+ 41	+ 47
Heliotrope	+ 8	+ 37
Lettuce	+ 50	— 31

	Water	Mineral content	Nitrogen	Hydrogen and oxygen	Carbon
Potato tubers	75 %	1 %	0,3 %	12 %	11,7 %
Rye, seed	13,4	2	1,8	41,8	41

formation of the coal measures now utilised by man, may be attributed to the larger quantity of carbon dioxide then present in the atmosphere. Taking this into consideration, RIEDEL worked out a method of applying carbon dioxide by utilising gases produced by combustion rich in this compound. These gases are available in large quantities, especially in the metallurgical industry. With this in view the DEUTSCH-LUXEMBURGISCHE BERGEWERKS UND HUTTEN A. G. of Dortmund took up the author's proposition, and made an experimental apparatus. Thus, in the spring of 1917, 3 glass houses 19.68 ft wide by 81 ft. long were constructed, and 2 of these were used for comparative experiments. Burnt and purified blast-furnace gas was introduced through a double set of perforated pipes running round one of the glass-houses.

The other, on the contrary, better exposed, received no carbon dioxide. The following table shows some of the quantitative results obtained :

Crops	Under glass with gas	Under glass no gas
	kg.	kg.
Tomatoes	29.5	138
Cucumbers	87.3	235

Thus, the addition of carbon dioxide apparently produced a surplus yield equal to 2 ½ times the control in the case of tomatoes, and to 1.7 times in the case of cucumbers. RIEDEL also arranged a scheme for the

treatment of plants in the open field with carbon dioxide. For this purpose, he set out square plots surrounded by perforated cement pipes, through which the residual blast-furnace gas was passed; at the same time an untreated field with a similar sandy loam soil served as a control. The results obtained with crops treated with carbon dioxide were as follows:

Spinach	2.5 times the yield of the control plot
Beets	1.5 » » » » »
Potatoes	2.8 » » » » »
Lupins green	2.74 » » » » »
Lupins dry	2.9 » » » » »
Barley	2.0 » » » » »

In 1918, the work was extended and the same interesting results were obtained; the surplus yield due to the carbon dioxide treatment was 2-3 times for the tomatoes under glass; in the open field, potatoes treated in a similar manner gave a yield 4 times as high and beets gave the following results:

	With CO_2	Without CO_2	Ratio
	kg	kg	
Plot of 1 sq. metre area + manure + fertiliser, one application	2.8	3.9	1 : 1.40
Plot of 1 sq. m. area + manure + fertiliser, double application	3.3	5.1	1 : 1.54
Ratio	1 : 1.18	1 : 1.30	—

It appears from this that the addition of carbon dioxide would prove useful also to the other manuring of the soil.

To complete these experiments, the treated air was analysed in order to determine the amount of carbon dioxide absorbed in glass houses containing tomatoes and in others that were not cultivated. In the first case, after stopping the inflow of carbon dioxide, the content fell to 0.1 to 0.2 %, and in the second case, 0.42 to 0.65 %, compared with 1 % at the start.

According to RIEDEL, these tests give a positive answer to the question raised by GERLACH namely that the addition of carbon dioxide contributes to a marked extent towards plant development, because the ordinary content of carbon dioxide in the atmosphere does not constitute an optimum. The unsuccessful results should be attributed to unfavourable experimental conditions or to other exceptional causes.

Another question must be asked: Can sufficient quantities of carbon dioxide at a reasonable price be obtained for fertilising purposes? With the hope that this problem may be successfully solved, the future of agriculture assumes a bright aspect. It is obvious that compressed carbon dioxide can not be employed as in previous experiments for this purpose except in case of absolute necessity, as such a method is both too expensive and inadvisable. Quite apart from the possibility of considerably reducing

the consumption of carbon dioxide, there are sufficient sources from whence the gas can be obtained cheaply.

Without taking into account the many combustion gases which require special treatment for the elimination of harmful ingredients, blast-furnaces gases constitute a convenient source of carbon dioxide. These gases contain, it is true, carbon monoxide, but, at normal concentration, it is not injurous to plants, and it is in the interests of heating economy to reduce the content as much as possible.

Other harmful constituents of blast-furnace gases are usually eliminated in most plants, in order to avoid injury to the apparatus. In several cases, the gases still contain sufficient heat to warm glass-houses to a large extent. The exhaust gas from gas engines should be especially useful, as it is under pressure, and therefore does not require machinery to distribute it, particularly if it has to travel several kilometres; a network of piping will be sufficient. As regard the amount of blast furnace gas available, it must be remembered that a furnace charged with 100 tons of coke burns 85 tons of carbon, capable of producing 320 tons of vegetable matter such as potatoes. In Germany, before the war, the siderurgical works used 4000 tons of coke daily in the blast-furnaces, and produced 35 million cub. metres of gas with 20 % of carbon dioxide per day. The lime kilns, as well as sugar refineries could also supply carbon dioxide.

The time will come, according to RIEDEL, when there will be special installations for supplying carbon dioxide for agricultural purposes, just as there are now special plants for the distribution of electric power. This possibility depends on a question of development which cannot be settled in a moment, but which will no doubt be cleared up when conditions are more favourable. Although it is possible that Germany may be able to obtain sufficient industrial carbon dioxide to give increased yields capable of covering the deficit in agricultural crops, until the time when this can be realised, great importance should be attached to organic manures as a source of carbon dioxide for plants. Considering that an increase in the foliar surface necessitates a greater absorption of carbon dioxide, all organic residue matter available should be collected in order to help in the formation of mould.

In conclusion, RIEDEL quotes the opinion of a German Horticultural Inspector, to the effect that the use of carbon dioxde as manure can hardly be neglected, as it constitutes, like nitrogen, phosphates and potash, an important factor in plant nourishment (1).

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(1) In the United States, CUMMINGS, M. B. and JONES, C. H. (*Journal of the Chemical Society*, Vols. 117-118, No. 689, Pt. I, p. 267. March, 1920), in carrying out experiments with a current of carbon dioxide under glass (boxes or frames), have obtained favourable results with peas, potatoes, strawberries, and lettuce, but not with radishes, which, however, matured early. In most cases, the plants grown with carbon dioxide showed a higher carbohydrate content and a lower protein content. Lettuce benefited the most when given 300 litres of carbon dioxide per day in boxes 130 × 70 × 30 cm. (*Ed.*)

627 – **Influence of Fertilisers on the Combustibility of Tobacco; Researches in Cuba.** — Moreno (Chief of the Department of Chemistry at the Agricultural Experiment Station, Cuba,) in the *Revista de Agricultura, Comercio y Trabajo*, Year II, No. 4, pp. 169-170; No. 8, pp. 377-379. Havana, 1913.

The author has attempted to show the influence of different fertilisers on the combustibility of tobacco, and states the conclusion drawn from practical experiments in Connecticut, Wisconsin and North Carolina, (United States), all of which support the idea that an excess of chlorides is harmful to combustibility, but that the deleterious effects of a known quantity of chlorides is annulled, provided that the soil contains a certain quantity of potash. The experiments made by the author were of a physical and chemical nature, and combustion trials were made with manufactured and leaf tobacco burnt in an automatic apparatus. Several chemical analyses of the stem were made at the same time to show the effect of various fertilisers on its percentage composition. Botanical studies were carried out on leaves which had shown a high coefficient of combustibility, in order to bring out the correlation of characters between the chemical properties and the botanical characteristics of a good leaf, in order to furnish certain data of use in the industrial selection of tobacco.

The experiments were carried out with tobacco from the 1914-15, 1915-16, and 1916-17 crops, grown on the best system available in the fields of the Agricultural Station at Cuba. The land reserved for these trials was divided into 50 small plots 16½ feet long, making 10 series of 5 plots, and these were manured with mixtures of the following fertilisers : — Double surperphosphate ; sulphate of ammonia or sodium nitrate or calcium cyanamide ; potassium sulphate or carbonate. When the plants were full grown, the harvest began, and the dried and prepared leaves were grouped in 3 classes : — Crown (extremity of the leaf), centre (median part), and base. A selection was made of leaves suitable for use in manufactured tobacco with leaves of the same thickness ; the coefficient of combustibility was in each case determined. The results obtained are indicated in Table I.

The author also carried out combustibility trials, with detached leaves by burning the extremity, the centre and the base of each leaf.

The results obtained are shown in Table II.

The author shows the influence of each fertiliser and the nature of the leaves on combustibility and draws the following conclusions :

(1) Double superphosphate, sulphate of ammonia and potassium sulphate increase the combustibility of tobacco.

(2) Calcium cyanimide should only be used in small amounts, because larger proportions produce toxic effects.

(3) Sulphate is the best potassic fertiliser ; the proportion can be increased with advantage to combustibility.

(4) Manufactured tobaccos which burn the best are those of homogeneous composition, those with a small bulk and light colour being preferable.

TABLE I. — *Influence of Fertiliser on Tobacco.*

Fertiliser	Duration of combustion in minutes	Colour of ash	Consistency of ash	Appearance of the combustion rings	Manner of burning	Classification
Double superphosphate, Sulphate of ammonia or calcium cyanamide, potassium sulphate or carbonate	60	Pale grey	Very consistent	Very fine	Very even	Good
None (control), . . .	10	Dark grey	Soft-ridged	Slightly large	Uneven	Bad
Double superphosphates, calcium cyanamide, potassium sulphate in double quantity	40	Grey	Compact	Fine	Even	Good

Fertiliser	Duration of combustion in seconds	Surphace in sq mm. of substance burnt	Thickness of Leaves	Colour of Leaves
Double superphosphate, sulphate of ammonia, calcium cyanamide, potassium sulphate or carbonate	78	48	Slight	Light
None (control).	10	11	Marked	Dark
Double superphosphate, calcium cyanamide, potassium sulphate in double quantity . .	42	31	Slight	Light

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

628 – **Oxidising Enzymes of Plants.** — ONSLOW, M. W. (Biochemical Laboratory, Cambridge), in *The Biochemical Journal*, Vol. XIII, No. 1, pp. 1-9. Cambridge, May, 1919.

The dual nature of an oxidase, *i. e.* peroxide-peroxidase, and the fact that one component, the peroxidase, is an enzyme, has been established by previous workers. The resolution of the system into its component parts has also been effected to some extent.

The present investigations, carried out with pears and potato tubers, indicated that the oxidation of an aromatic compound, giving the reaction characteristic of the catechol group, gives rise to the peroxide, and that it is the peroxidase itself which activates this oxidation. The aromatic compound can be separated from the peroxidase by a chemical process, and the two components can afterwards be recombined anew. The peroxidase thus separated turns guaiacum blue only when hydrogen peroxide is added. If the peroxide-peroxidase system is synthesised afterwards by combining the separated substances, it will then turn guaiacum blue. The peroxidase activates the oxidation of the aromatic substance giving rise to peroxides and this system peroxide-peroxidase will then act on guaiacum. In plant

tissues which turn brown on injury or exposure to chlorophorm vapour the peroxidase is associated with the aromatic compound : tissues which do not turn brown on injury, do not contain a substance with the catechol grouping, and their enzymes do not catalyse the oxidation of substances grouped thus.

629 – **The Effect of Potassium Salts on the Anatomy of *Dactylis glomerata*** — Purvis O.N. (Royal Holloway College, University of London, and Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. IX, Pt. 4, pp. 338-365, Figs. 23, Bibliogr. of 9 works. Cambridge, Oct., 1919.

Potassium compounds play an important part in the metabolism and growth of plants. Amongst these effects are some which have received little attention from investigators, such as the effect on the strength of the stems of herbaceous plants, which may be due to strengthening of the mechanical tissues, or to some other influence on the chemical composition of the walls, or on the physiological condition of the plants.

During the summer of 1917, the author investigated the effect of potassium salts on the anatomy of *Dactylis glomerata*. Plants were collected both from field plots which had received potassic fertilisers, and from those which had not. The yield of hay from these plots was in close agreement with the average, which shows that the season during which the work was done was not abnormal. The thickness of the wall, the diameter of the lumina and the ratio of the lumen to the wall, were measured both in the sclerenchyma and metaxylem.

It was found that in the early stages of the sclerenchyma the walls were thinner where potash had been supplied, but this effect was lost as the season progressed. The lumina were larger in plants which had received potash but no nitrogenous fertilisers whilst in the presence of ammonium salts, this effect was reversed. In the xylem, the thickness of the walls was unaltered whether potassic fertilisers were used or not. When no nitrogenous fertilisers were added, the diameter of the lumen decreased when potash was present, but when ammoniun salts had been applied as well, the diameter was increased. The addition of potassium salts, however, produced an increase in the ratio between the lumen and the walls of the vessels, but this effect gradually passed off. Presumably, therefore, potassic fertilisers reduced the strength of the mechanical cells during the early stages of development.

From these results, it is concluded that the rigidity of plants supplied with potassium salts, is not due to anatomical strengthening, but must be attributed to other causes, such as the influence of the salts on the physiological condition of the plant, or on its chemical composition.

630 – **Observations on the Stimulative Effect of Copper Sulphate on Plants.** — Montemartini, L., in the *Rivista di Patologia vegetale*, Year X. No. 3, pp. 36-40. Pavia, Feb., 1920.

The author has previously demonstrated (1) that copper sulphate absorbed in very dilute solutions (0.005 to 0.02 %) and in small amounts, can exercise a stimulative effect both on the respiration and chlorophyll

(1) See *R.*, Nov.-Dec., 1911, No. 3110. (*Ed.*)

assimilation of plants. Can this same salt exert the same effect when spread on the outer surface of the leaves ? This question has been discussed, but that it is probable is suggested by the fact that anticryptogamic sprays compounded of the copper salts almost always result in vigorous growth which cannot be entirely explained by the absence of parasites, This action proceeding from the exterior, varies according to the species, more than the action exerted in the interior by the absorption through water channels: it varies especially according to the structure and nature of the cuticle, which is more or less resistant to the passage of moisture. The author has therefore re-opened the question by employing glycine, a plant whose leaves are very sensitive to the action of copper sulphate. It was found sufficient to stimulate these by sprinkling a few drops of a 0.04 % solution of copper sulphate on the upper surface, which caused a greater formation of dry matter. From the results obtained, the author concluded that copper sulphate, sprinkled in dilute solution on the outer surface of leaves of certain plants, exerts a double beneficial action: on the one hand it stimulates chlorophyll assimilation by causing more abundant formation of organic matter ; on the other hand, it also stimulates the circulation and assists the passage of organic substances from the leaf blade to the stem. As a result, special effects ensue in connection with the circulation of the mineral substances contained in the leaf ash.

631 – **On the Supposed Parthocarpy of the Hazel.** — TROTTER A., in *Atti della R. Accademia dei Lincei*, Rendiconti, Serie V, Classi di Scienze fisiche. matematiche e naturali, Vol. XXIX, Pts. 1-2, pp. 72-76, Figs 10. Rome, Jan. 8, 1920.

It has been stated that hazel shows the phenomenon of vegetative parthocarpy and this has been suggested as the explanation of the fall of the young fruit.

The question has been studied experimentally by the author, who enclosed the bushes under movable glass frames and endeavoured to provoke fructification without preliminary pollination. An entirely negative result was obtained.

The presumption that the fall of young fruits is due to parthocarpy can therefore be excluded, and the author considers that it is, on the contrary, due to a form of degeneration of the reproductive system, that is to say, a true abortion, (both ovular and embryonic) comparable to that of animals.

632 – **Plant Breeding and Tropical Crops.** — BATESON, W., in *The Agricultural Journal of India*. Vol. XV, No. 1, pp. 55-62. Calcutta, Jan., 1920. PLANT BREEDING

The crops in temperate countries, for many centuries and in largely populated areas, were put through several genetic stages in the process of improvement and thus tended to differ increasingly from the original types and to be gradually improved.

But, in spite of the considerable improvement aleady obtained, it is evident that the plant breeder, by the selection of valuable types and still more by hybridisation, still succeeds in obtaining immense improvements.

This being granted, it will now be easy to imagine the splendid results which could be obtained by the selection of tropical crops, until now not attempted.

For instance, the coconut is always the same in all the points of the immense area through which it is distributed, and the few local races which exist are very imperfectly differentiated. Taking their geographical distribution as a whole, the coconuts represent a population composed of several type varieties ; but within one individual plantation, it is possible after a simple superficial examination to distinguish distinct differences in respect of the mode of growth, the shape of the leaves, the quality and quantity of the produce. Nothing has yet been done to select the best types and to isolate and propagate them. When choosing and sorting nuts for planting, the planter always gives preference to the best developed and the most prolific plants. This, however, is not sufficient to guarantee success. The monœcious coconut is in reality essentially dichogamous, which accounts for the fact that fine palms can be fertilised with the pollen from very defective males and still produce nuts that are well developed, but incapable of producing plants of superior quality. The author considers it possible adequately to control fertilisation by means of artificial pollination, which will give first-class seed for sowing.

There remains a great deal to be done in thus direction even from a purely physiological point of view. The mechanism of pollination and fertilisation is not yet perfectly understood, and the possibility of self-fertilisation cannot be excluded *a priori*. Vegetative reproduction (as practised with the date) has, according to the author, not yet given positive results. Similarly, *Hevea brasiliensis* shows variation to an enormous extent Among a group of 29 trees of uniform age, grown under similar conditions, the highest and lowest average yields were respectively 166 and 8 cc. and the circumference of these two trees was 52 and 32 inches respectively. With regard to the selection and hybridisation of *Hevea*, nothing has yet been accomplished ; good results have, however, been obtained by propagation of the better strains by vegetative reproduction.

In Java, the Dutch have obtained very encouraging results by applying methods of seed selection to *Cinchona*, thereby nearly doubling the yield of alkaloid.

In India, America and Egypt, a considerable measure of success has been attained with cotton selection, whist Burkill and Finlow have made a beginning with jute, which at present consists of a mixture of most divergent forms.

633 – **Studies in the Pollination of Indian Crops, and the Possibility of Improvement by Selection.** — Howard, A., Howard, G. and Abdur Rahman Khan, in *Memoirs of the Department of Agriculture in India*, Vol. X, No. 5, pp. 195-220. Calcutta, Dec., 1919

The methods of pollination and the frequency of cross fertilisation are two questions of the first importance as regards the improvement of crops in India by selection. On these subjects, in fact, depends the method to be adopted, the choice of material, and the distribution thereof. In the

present paper, the authors present the results obtained in a series of trials conducted at Pusa with a view to studying the pollination mechanism of the following crops : San hemp (*Crotalaria juncea* L.) pigeon pea (*Cajanus indicus* L.), Java indigo (*Indigofera arrecta* Hochst.), Sumatran indigo (*Indigofera Sumatrana* Gaert.), linseed (*Linum usitatissimum* L.), taramira (*Eruca sativa* Lam.), til (*Sesamum indicum* L.), niger (*Guizotia abyssinica* Cass.), jute (*Corcherus capsularis* L. and *C. olitorius* L.), and roselle (*Hibiscus Sabdariffa* L.).

Some of the results obtained and described, especially those dealing with *Cajanus, Indigofera* and *Crotolaria,* are the most important from the point of view of applied pure line selection.

With *Cajanus* the question of yield holds the foremost place. The problem before the breeder, therefore, is to secure the heaviest crop possible before considering the quality. Now, the research on pollination and fertilisation shows that other factors, besides potential yielding power are involved, in particular, atmospheric conditions. Practically no setting takes place in damp and dull weather. This adverse condition can be avoided by increasing the range of the flowering period, and thus distributing the risk over a longer interval.

The author advises the use of a mixture of individuals differing considerably in time of flowering. This method, however, involves the necessary rejection of pure-line selection and the adoption in its place of mass selection.

With *Indigofera arrecta,* the case is still more interesting. The crop consists of a mass of heterozygotes with a wide range of general habit, root development, extent of leaf surface, and time of flowering. Cross-fertilisation is a normal process, but practically no setting takes place if insects are excluded. There as been so much crossing in the part, and the gametic constitution of each individual is so complex, that many years work would be necessary for the isolation of the unit species which underlie the existing fabric of heterozygotes . But, even if such a result were obtained, a new drawback would probably arise, namely a lowering of vitality that would render the pure lines finally obtained, worthless for any agricultural purposes.

Methods of continuous mass selection which were successfully adopted by the Dutch planters in Java are far more promising. Crossing cannot be prevented but if it is to be regulated, defective cultures should be eliminated so that crossing is only permitted between those cultures which are agriculturally desirable.

The authors then summarise the results obtained with the best crops.

San-hemp (*Crotolaria juncea* L.). — If flowering takes place in muslin bags, the pollen is liberated and forced on to the stigma, but no subsequent setting takes places ; the flower itself even, gradually fades after a few days. This does not prevent the possibility of self-fertilisation, which, however, cannot take place unless the stigma is first stimulated by contact with insects. One consequence, therefore, of insect visitation is self-pollination. Stimulation of the stigmatic surface does not appear

necessary, however, for cross-pollination. The frequency and the facility of natural crossings obtained with cultures of very different habit grown side by side, *e. g.* the local Pusa variety and the Jubbulpore variety from the Central Provinces within a few years only, gave an indistinguishable variety showing elimination of the marked differences of habit of these two varieties. For these reasons, it may be concluded that improvement of crops by selection is not an advantageous proceeding. It is doubtful if the enormous amount of work necessary to combat the continued counter-activity by vicinism to any extent, would repay the cost and trouble involved.

Pigeon Pea (*Cajanus indicus* Spreng.). — The numerous marked characteristics noticeable with the progeny of one parent plant indicated the frequency of natural cross-fertilisation. To determine the precise extent of natural crossing, some observations were made in 1912-13 on a pure culture of " arhar " (var. *bicolor*), characterised by pale yellow flowers and white seed, which made the detection of heterozygotes an easy matter. Of this pure culture, 140 single plants were selected and sown separately the following year. Natural crossing was found to have occurred in 91 of the cultures, that is, in 65 %. The characters which best lend themselves to the detection of heterozygotes and which show the kind of splitting which takes place are : the general colour of the standard, the colour of the pods, and the character of the seed coat The flowers may be either pale yellow, deep yellow, or orange, with or without reddish lines,etc., on the back of the standard, and each of these types gives rise to progeny with the most extraordinarily varied characteristics. The pods may be green or variously marked with red or black, the latter markings being sometimes present to such an extent that the pod appears to be entirely covered. The seed coat may be white, grey, brown, reddish-brown, purple, smoky or black, and usually in addition to this ground colour, brown, black, violet or red spots.

There appears to be no obvious connection between the colour of the seeds and that of the flowers, and in any case the peculiarities after splitting showed the heterozygous complexity of the plant in question.

The difficulties that attend pure line selection are evident. In addition to this, the flowering period of the local crop was much greater that than of the pure culture. The effect of adverse weather conditions is therefore in the former case less harmful, as only a part of the plants in flower can be attacked or damaged.

In 1911-12, at Pusa, one of the most promising of the pure lines (characterised by pure white sed and a pale yellow standard) was compared with the local mixed crop, and gave a yield inferior to the latter, in the ratio 1 : 2.5. The local crop thus showed an output twice as high as the pure culture.

The sets in the pure culture were distinguishable with regard to productivity according to the behaviour of the homozygotes and the heterozygotes ; the latter gave nearly three times the yield of the former.

These results lead to negative conclusions concerning the advantages

of pure line selection. The shortening of the flowering period and the lack of stimulation due to heretosis are liable in every case to decrease the yield considerably. Continuous mass selection, then, is more advisable.

JAVA INDIGO (*Indigofera arrecta* Hochst.) and SUMATRA INDIGO (*I. sumatrana* Gaertn.). — With *I. arrecta* self-fertilisation is a very difficult matter, the visits of bees being necessary for seed formation. With *I. sumatrana* no setting takes place if cross pollination is hindered by artificial means. However, even with flowers thus isolated, setting can be produced (not always, it is true) if the flowers are artificially made to explode ("heterosis"). The attempts to cross these two species have so far failed.

LINSEED (*Linum usitatissimum* L.) — The linseed cultivated in India as an oil-seed, is very different from the European form grown for its fibre ; it is a short, much branched plant with thick stems and numerous capsules.

For some years, a large collection of pure lines of Indian linseed obtained from the black soil areas of Peninsular India, and also from the Plains (N. India) have been under investigation. From the observations and experiments made with the anthers and pollination, it was concluded that self-pollination is a practical certainty, in such a way that even if bags are employed, this does not interfere with setting and there is no apparent falling off in vigour in the progeny produced in this way.

TARAMIRA or DUAN (*Eruca sativa* Lam.). — (See Table I.)

Flowers bagged and afterwards left untouched		Flowers pollinated				Cross-pollinated from other plants	
		from flowers of the same inflorescence		from flowers of another inflorescence on the same plant			
Flowers treated	Pods formed	Flowers treated	Pods formed	Flowers treated	Pods formed	Flowers treated	Pods formed
79	0	18	1	42	6	24	24
		24	1	13	0	30	30
				20	0	13	13
				19	0	14	14
				16	0	18	17
				36	6	10	10
				22	4	10	10
				43	0	12	10
						34	34
79	0	42	2	211	16	165	162
		These 18 pods as a rule contained only one seed each.				Pods well filled with seed.	

Cross fertilisation, however, is, possible. In 1916, the seed of 340 bagged plants was sown and 334 bred true, whilst splitting took place in 6 cultures only. In 1917, the seed of 233 plants were sown under similar conditions and all bred true except one which split as regards habit and flower colour. It thus seems that cross-fertilisation is more frequent than would be suspected from a study of the flowers; hence the necessity for isolation in accurate work on the genetics of the crop.

Self-fertilisation is exceedingly rare; setting is consequently the result of cross-fertilisation. The crop is therefore a mixture of freely-crossing heterozygotes.

Til (*Sesamum indicum* L.). — Self-fertilised. In 1910 the seeds of a large number of single plants were sown separately at Pusa and the progeny examined. There was no doubt that many of these were heterozygotes, which signified the possibility of natural crossing. A study of the homozygotes and the heterozygotes made it possible to determine the characters of the various Indian types of til.

Rough and Smooth seeds. — As a rule, the surface of the seed is smooth, and with homozygotes this is always the case; in the cultures raised from some heterozygotic smooth parents, some plants with rough seeds were produced.

Colour of corolla. — Almost pure white to deep violet.

Branching. — Those types with one flower in the axil are generally much branched while those with 3 flowers have few or no branches.

Number of flowers. — As a rule, only one flower is produced in each leaf axil, the other two bud-like bodies developing into extra floral nectaries. Sometimes on the contrary, 3 flowers are developed and without any branching.

Other distinctive characters may be observed in the form of the leaves, and in the hairiness of corolla and capsule.

Niger (*Guizotia abyssinica* Cass.). — Cross-fertilisation is common in this crop and, consequently, the cultures containing heterozgotes are prevalent. Splitting took place in the following characters: — Time of maturity, colour of the stem (green, red or intermediate tints), habit (branching or erect), size and margin of the leaves, colour of the seeds, and height of the plant.

Round-podded Jute (*Corcherus capsularis* L.). — The prevalence of self-pollination and the comparative ease with which heterozygotes can be detected and removed before flowering takes place, render improvement of this crop possible by means of pure-line selection.

Long-podded Jute (*Corcherus olitorius* L.). — The rarity of natural crossing, and the fact that each plant pruduces a large quantity of seed should render improvement by selection certainly possible.

Roselle (*Hibiscus Sabdariffa* L.). — Self-pollination is the general rule. A few cases of natural crossing were observed duè to the visits of humming birds.

34 – **Criticism on the "Crossing Over" Theory, according to the Calculation of Probabilities.** — NACHSTHEIN HANS, in *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. XXII, Pt. 2, pp. 127-141, figs. 4. Leipzig, Jan. 1920.

The author, arguing from a mathematical standpoint, sets out to refute the objections raised by TROW with regard to the "crossing over" theory (1) formulated by MORGAN.

Suppose that there are 6 factors for each chromosome :—

A B C D E F
a b c d e f } homologous chromosomes.

On varying the point of exchange or crossing according to the law of probabilities, 5 possible forms of crossing (see fig. 1) will be obtained :

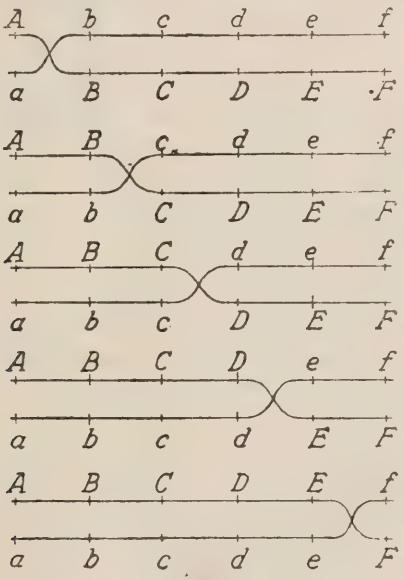

Fig. 1.

With these 5 forms of crossing, the following new combination of factors occurs :—

1 Ab	2 Ac	3 Ad	4 Ae	5 Af
	1 Bc	2 Bd	3 Be	4 Bf
		1 Cd	2 Ce	3 Cf
			1 De	2 Df
				1 Ef

The number of crossing possible between two factors (in 2 homologous chromosomes) increases proportionately to the distance between the two factors. Factor **F** for example, is placed 5 units from **A, D** 3 units and **B**

(1) See *R.*, Jan., 1918, No. 29, pp. 52-54, note (1). (*Ed.*)

one unit. Therefore, the combination **Af** is reproduced 5 times, **Ad** 3 times, etc. The percentage between 2 of these 6 factors results from the following combinations :—

Ab / AB	1/4	= 20% ;	Bc / BC	1/4	= 20% ;	Cd / CD	1/4	= 20% ;	De / DE	1/4	= 20% ;
									Ef / EF	1/4	= 20% ; cross-overs
Ac / AC	2/3	= 40% ;	Bd / BD	2/3	= 40% ;	Ce / CE	2/3	= 40% ;	Df / DF	2/3	= 40% ; cross-overs
			Ad / AD	3/2	= 60% ;	Be / BE	3/2	= 60% ;	Cf / CF	3/2	= 60% ; cross-overs
						Ae / AE	4/1	= 80% ;	Bf / BF	4/1	= 80% ; cross-overs
									Af / AF	0/5	= 100% ; cross-overs

If 1 chromosome contains on the contrary, 26 factors, **A, B, C. Z...** the following would be the result :—

Ab / AB	1/24	= 4 % cross-overs ;
. . . . .		
Az / AZ	25/0	= 100 % cross-overs .

If 1 chromosome contains n factors ; the following general formula will be obtained (to determine the percentage) :—

$$\frac{1}{n-2}, \quad \frac{2}{n-3}, \quad \frac{3}{n-4}, \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad \frac{n-1}{n-n}$$

Application of these formula shows that :—

$$\frac{Ab}{AB} = \frac{100}{Ab'} \qquad \frac{Ac}{AC} = \frac{100}{Ac'} \quad \text{etc.}$$

The percentages of " cross overs " constitute an arithmetical progression :—

$$\frac{1 \cdot 100}{n-1}, \quad \frac{2 \cdot 100}{n-1}, \quad \frac{3 \cdot 100}{n-1}, \quad \text{etc.} \ldots \ldots \ldots \quad \frac{(n-1) \cdot 100}{n-1} .$$

Whilst the number of cross-overs increases with the distance of the factors, the number of " non cross-overs " decreases, up to this point, and mathematical analysis does not in any way contradict MORGAN's theory.

What will happen now, if, instead of only one, 2 or more cross-overs are observed ? Figure 2 (p. 712) illustrates this case of double crossing

ver, the 6 factors remaining invariable, as in the preceding case. The ollowing combinations are possible :—

1.	4 Ab	3 Ac	2 Ad	1 Ae
2.		3 Ac	2 Ad	1 Ae
3.			2 Ad	1 Ae
4.				1 Ae
—	4 Ab	6 Ac	6 Ad	4 Ae

The percentages of cross-overs are :—

$$\frac{Ab}{AB}\ \frac{4}{6} = 40\%. \quad \frac{Ac}{AC}\ \frac{6}{4} = 60\%, \quad \frac{Ad}{AD}\ \frac{6}{4} = 60\%;$$

$$\frac{Ae}{AE}\ \frac{4}{6} = 40\% \text{ cross-overs.}$$

Supposing that there are 26 factors A. . . . Z. the following com inations will be obtained :—

1.	24 Ab	23 Ac	22 Ad	21 Ae	20 Af	19 Ag	—	1 Ay
2.		23 Ac	22 Ad	21 Ae	20 Af	19 Ag	—	1 Ay
3.			22 Ad	21 Ae	20 Af	19 Ag	—	1 Ay
4.				21 Ae	20 Af	19 Ag	—	1 Ay
5.					20 Af	19 Ag	—	1 Ay
6.						19 Ag	—	1 Ay
...								...
...								...
...								...
4.								1 Ay

24 Ab 46 Ac 66 Ad 84 Ae 100 Af 114 Ag ... 84 Av 66 Aw 46 Ax 24 Ay.

Therefore, in the case of double crossing-over, the percentages of cross- vers do not form a series in arithmetical progression, but occur in the orm of a symmetrical curve. In other words, the number of cross-overs s not proportional to the distance between the factors.

Whilst, in reality, for series A . . Z. in the case of one single crossing- ver, the following percentages of cross-overs occurs :—

$$\frac{Ab}{AB}\ \frac{1}{24} = 4.0\% \ldots \frac{Af}{AF}\ \frac{5}{20} = 20.0\% \ldots \frac{Am}{AM}\ \frac{12}{14} = 48.0\%.$$

$$\frac{An}{AN}\ \frac{13}{12} = 52.0\% \ldots \frac{Au}{AU}\ \frac{20}{5} = 80.0\% \ldots \frac{Ay}{AY}\ \frac{24}{1} = 96.0\% \ldots \frac{Az}{AZ}\ \frac{25}{0} = 100\%;$$

n the case of a double crossing-over these are :—

$$\frac{Ab}{AB}\ \frac{24}{276} = 8.0\% \ldots \frac{Af}{AF}\ \frac{100}{300} = 33.3\% \ldots \frac{Am}{AM}\ \frac{156}{144} = 52.0\% \ldots \frac{An}{AN}\ \frac{150}{144} = 51.0\%;$$

$$\frac{Au}{AU}\ \frac{100}{300} = 33.3\% \ldots \frac{Ay}{AY}\ \frac{24}{276} = 8.0\% \ldots \frac{Az}{AZ} = \frac{0}{300} = 0\%$$

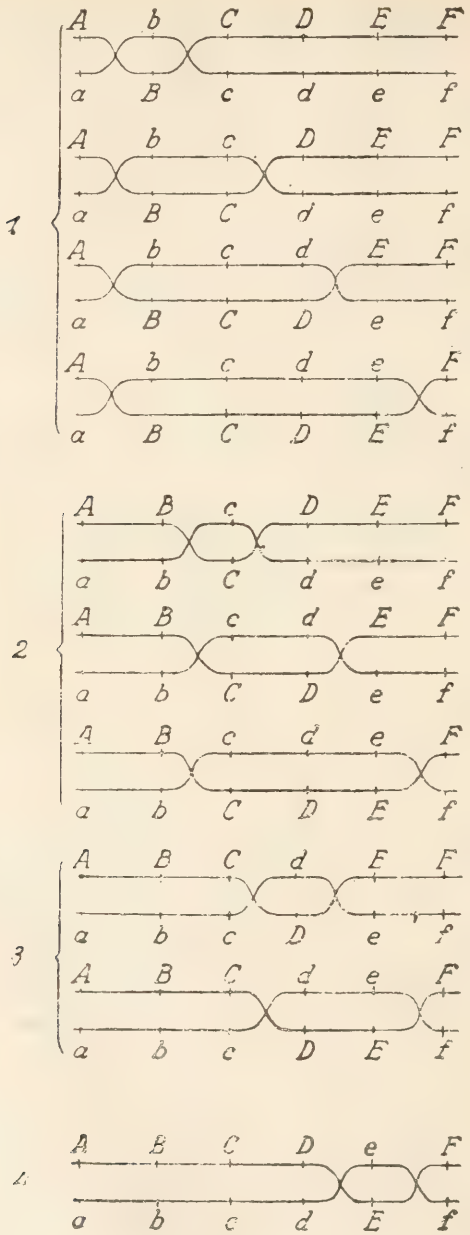
1
A b C D E F
a B c d e f
A b c D E F
a B C d e f
A b c d E F
a B C D e f
A b c d e F
a B C D E f
2
A B c D E F
a b C d e f
A B c d E F
a b C D e f
A B c d e F
a b C D E f
3
A B C d E F
a b c D e f
A B C d e F
a b c D E f
4
A B C D e F
a b c d E f

Fig. 2.

Therefore in the case of a double cross-over, the maximum number of cross-overs should be between A and M and between A and N.

Now, the distance between M and A (between N and A) is obviously less than the distance between A and X (A and Y). Although Y may be 24 times further from A than from B, the two combinations Ab and Ay are equal.

(An equal percentage of cross-overs, in the case of a simple as well as of a double cross-over, only occurs with A—N, being always 52 %).

The percentage of cross-overs increases from extremity up to median point in the chromosome, and then decreases, gradually, till the other extremity is reached.

According to the MORGAN method, the determination of the *locus* of the chromosome factors is based on the percentage of cross-overs, allowing that the higher this is, the greater should be the distance between the two factors in question. Then, after what has been shown above, the principle applies only in the case of a simple cross-over, but loses all its validity, in the case of a double cross over. Things become even more complicated if, instead of 2, there are 3, 4, 5 and anything up to 25 crossing-overs (given that the number of points where crossing is possible is equal to the total number of factors minus 1).

In this last case, the two homologous chromosomes should resemble a double spiral with numerous compact convolutions (see Fig. 3).

$$\frac{Ab}{AB} = \frac{Ad}{AD} = \frac{Af}{AF} = \ldots\ldots = \frac{Az}{AZ} = \frac{1}{0} = 100\ \%\ \text{cross-overs}$$

$$\frac{Ac}{AC} = \frac{Ae}{AE} = \frac{Ag}{AG} = \ldots\ldots = \frac{Ay}{AY} = \frac{0}{1} = 100\ \%\ \text{non cross-overs}$$

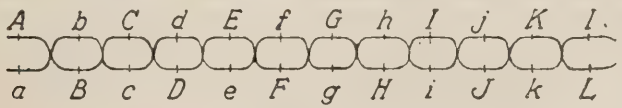

Fig. 3.

As regards a simple exchange between factors, no objection can be raised to TROW's arguments. On the other hand, the results are evidently in accordance with MORGAN's conclusions, obtained by a process of induction; the percentage of exchanges increases proportionately with the distance between the two factors.

But the ratio differs when two or more cross-overs are under consideration. If it is true that the phenomenon of the double, triple, etc., cross-over was so frequent, as TROW admits, the localisation of the factor in the chromosome, based on the percentage of cross-overs, would be impossible.

But, to admit the frequency of double, triple, etc., crossing-over, constitutes the weak point in TROW's argument; these cross-overs are in reality very rare.

Therefore, in the determinations made by MORGAN on the behaviour

of 3 factors in chromosome *I* (=sexual chromosome), out of 10 495 cases, 3514 gave simple cross-overs and 9 gave double cross-overs, and 6972 neither one nor the other.

Experiments conducted by SARTEVANT are equally interesting:— In one experiment, dealing with 3 factors in Group I, out of 308 cases, 113 gave simple cross-overs, 1 a double cross-over, and 194 none. In a second experiment, out of 439 cases, there were 161 simple, no double, and 278 none. In a third experiment, dealing with 4 factors, also in Group I, out of 635 cases, there were 228 simple, 4 double and 393 none.

M. MÜLLER gives an analysis of 12 factors of chromosome I and 10 of chromosome II.

Chromosome I. — There was scarcely any change in 54.4 %, of the cases, whilst simple crossing-over gave 41.6 %, and double crossing-over only 4 %.

Chromosome II. — No cross in 32.5 % cases, simple in 51.1 % cases, double in 15.2 %, and triple in 1.3 % cases.

It can at least be concluded from the results at present obtained, that double, triple, etc., cross-overs are very rare compared with simple cross-overs, and the error that they may cause in the localisation of the factor in the chromosome is practically negligible.

The scheme for simple exchange constitutes therefore the mathematical basis of the crossing-over theory, in which the percentage of cross-overs gives a series in arithmetical progression. The result obtained by TROW by deduction agrees entirely with those obtained by MORGAN by the induction method.

635 – **"Pusa No. 4", Indian Wheat Variety imported into France because of its Early Maturity and Resistance to Scorching.** — SÉVERIN, R., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VI, No. 12, pp. 313 and 324-325. Paris, March, 1920.

The author presented to the Academy some ears of the Pusa No. 4 wheat variety, selected by Prof. HOWARD of the Cereal Station of the University of Pusa. This wheat has the characteristics of rapid growth and of carrying its grain normally until mature, even if sown very late after the last rains, or if there is no rainfall from sowing time until harvest. This was proved at Vaucluse by M. BRULAT, in spite of a persistant north west wind after the sowing at the end of March., followed by an exceptional drought during the summer of 1919; also at Toulouse by Prof. RIVES, at the University Agricultural Institute, and at Bagnols sur-Garonne, by M. ROUART (sown on April 5), and also on the author's own trial plots at Clos-l'Arat, Fontet, near Réole (Gironde). The ears taken from these cultures were ripe in 90 days.

Several other varieties of Indian wheat with a rather less fine grain sown in the spring of 1919, escaped the rust which ruined the autumn sown varieties in 1918, and gave results which the author hopes to confirm this year. The author is also testing further samples from the Experimental Stations in Australia and the United States, bearing in mind the fact that the Indian wheats are particularly resistant to drought, and excess of moi

ure, and are thus valuable for improving wheats in countries that suffer rom excessive heat and dryness.

36 - **The Traumatic Production of a New Form of Maize: *Zea Mays*, var. *polysperma*.** — BLARINGHEM, L. in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 11, pp. 677-679. Paris, March 15, 1920.

From *Family* II of a teratologic type of maize descended from the eeds of a type *B* obtained in 1907 after sectioning the main stem (1), the uthor isolated a line of maize with " shrunken leaves ", described in 911 and since then the line *Zea mays* var. *polysperma* with fruits composed of 2 and occasionally 3 closely-packed caryopses. The double caryopses re united on their homologous surfaces and the embryos are at the extremity of the diameter perpendicular to the point of contact. The general ymmetry is more easily observed in the very rare fruits consisting of carpels and 3 embryos.

In 1911, an interesting correlation was observed between the male nflorescences and the ears of aberrant varieties. All the plants with ars containing double seeds, produced panicles which though exclusively nale, showed fusions and repetitions of the floral parts :— glumes and ales either 3 or 4 in number, glumes with large parallel nervures in twos r threes, and supernumary or forked pales, stamens, 4, 5 and up to 7 in he same flower, authers fused or forked.

The male inflorescences opened before the appearance of the stigmas, nd all those not showing the anomaly could therefore be suppressed beore pollination. Since 1911, the author has reserved for pollination purposes solely the panicles showing a large proportion of abnormal ears; he pollen was supplied both by normal and abnormal blossoms. In ddition, to avoid the sterility to which entirely self-pollinated strains of naize are liable, the author introduced in 1913 as accessory male parents, lants derived from another tetralogical strain of maize " à grains acajou " btained from *Family* I. In the choice of ears destined for propagation y breeding, the author has always attributed more importance to those ith double grains rather than to the actual number of these double grains n the ear selected.

Thanks to these precautions, the author has been able to propagate a ew type in which the characters are transmitted with great regularity.

An ear in 1911, bearing 9 double grains gave :—

	Plants with double grains	Plants with single grains
In 1912	48	17
In 1913	71	54
In 1914	not noted	not noted
In 1918	46	62
In 1919	57	71

(1) L. BLARINGHEM, *Mutations et traumatismes*, p. 42. Paris, 1907 ; Foot note A. (*Author's note*)

At the same time the proportion of multiple caryopses on the more striking ears, rose from 5 % (1911) to 95 % (1919).

In conclusion, the author may be said to have obtained, amongst the strains from grain developed on a terminal inflorescence (consequently fasciated), a new strain of maize showing fasciation, even to the reproductive organs.

637 – **Pedigree Selection Applied to the Rice Variety, "Nang-Meo" in Indo-China.** — CARLE, E. (Agricultural Inspector, attached to the Plant Breeding Laboratory at the Scientific Institute, Indo-China), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year 2, No. 3, pp. 73-75. Saïgon, March, 1920.

The author gives the characteristics of the "Nang-Méo" variety so as to allow comparison to be made, with the results obtained later by pedigree selection :—

Origin	Bacliêu
Date of receipt by author	1912
Colour of outer coat	brown golden yellow, several brown bristles.
Shape	fairly long
Weight of 1 000 grains	28.5 gm.
Percentage of red grain	8 %
Percentage of kernels	51.09 %
Percentage of husks	18.91 %
Average yield per hectare	1500 to 2000 kg.
Vegetation period at Saïgon	160 to 170 days.

This variety possesses all the characters of a group containing numerous types, and pure line selection would no doubt give excellent practical results and lead to the isolation of the better varieties.

The following Table gives a summary of the results of the first trial carried out at the Phu-my Experiment Station.

	Number of line	Number of ears per 100 tufts	Weight of ears in kg.	Average weight per ear in gm.
F_1	Group	800	1.210	1.51
	N° 1 060	1 775	2.916	1.65
	» 1 032	1 101	1.880	1.70
	» 1 069	753	1.362	1.89
	» 1 044	920	1.820	1.97
F_2	» 1 060	749	1.716	2.32
	» 1 032	905	1.384	1.53
	» 1 069	646	1.387	2.14
	» 1 044	729	1.345	1.84
F_3	» 1 060	677	1.700	2.51
	» 1 032	835	1.940	2.32
	» 1 069	1 027	2.497	2.40
	» 1 044	1 100	2.011	1.85

This Table shows that the highest yield is obtained in the F_1, but that two lines of the F_2 show a much higher yield than those in the F_3. These should be worth observation, especially as the divergence lies with the plants selected in one culture, whilst the yield given in the table for the 3 generations is an average yield for the total number of tufts belonging to these lines.

The low quantity of seeds obtained as yet by purely biological selection does not yet allow more than small-scale trials. The author is limited therefore to making cultures, on the one hand with selected pedigree seed and on the other, with ordinary seed sorted with the MAROT sorter or CERTANI table.

Although ordinary seed gave an average yield of only 2000 kg. on several plots, the pedigree mixture gave 4019 kg. per hectare at the Phu-My Experimental Station.

From the results so far obtained, the author has found :—

1) A distinct similarity in vigour, height, inflorescence, and maturity.

2) That the difference in the dates of flowering of one line and another is from 10 to 15 days.

3) That the weight of the ear obviously increases in the third generation.

638 – **Sugar-cane Breeding in North India.** — VENKATRAMAN, T. S., in *Agricultural Research Institute, Pusa, Bulletin* No. 94, pp. 1-17, pl. VI. Calcutta, 1920.

The steady increase in the quantity of white sugar imported into India, combined with its low prices, has had such a depressing effect on the native " Gur " (crude sugar) industry that the attention of the Government has been directed to this industry with a view to putting it on a satisfactory basis.

The measures adopted are of two kinds : 1) The improvement of sugar canes and manufacturing methods ; and 2) the improvement of local varieties.

The work of breeding a better cane for North India, was entrusted to the breeding Station at Coimbatore, Madras under C. A. BARBER (1912).

The sole disadvantage of the selected site at Coimbatore lies in the fact that it is in a portion of India subject to meteorological conditions very different from those in the northern regions, the final destination of seedlings produced at the Station. On the other hand, however, the sugar cane rarely flowers in North India, and even if it does, the seed does not usually set. As this is a necessity in plant-breeding work, the Station was therefore chosen further south.

During the early years, the varieties that flowered were mostly thick canes : the seedlings produced were consequently also thick, and therefore unsuitable for introduction into North India. Later on, however, it was found possible to induce many of the thin canes also to flower, and in February, 1918, the first batch of seedlings was ready for distribution for trial purposes.

Crossing of the sugar cane presents peculiar difficulties. Fortunately

certain varieties exist which are male sterile in different degrees. If this sterility is absolute, by enclosing such flowers with a muslin bag and introducing into it some known pollen, a cross can be obtained of known parentage, such as Co. 205. If, on the contrary, it is only a case of partial sterility, the seedlings will either be selfed or cross-pollinated.

Both these are referred to as " bagged crosses ". It was found that bagging an arrow frequently exerted an adverse influence on its seed setting, and therefore, in later years, crossing was done by merely marking the another arrows and keeping them constantly dusted with some known pollen till the stigmas were found to wither. These are called " unbagged crosses ".

The resultant seedlings are still more uncertain and may be :—

a) Selfed.

b) Crossed with paternal pollen.

c) Crossed with some unknown parent through some stray wind-borne pollen.

Such is the constitution of Cos. 214, 215 and 216.

To systematise the work as far as possible, and to guarantee that each character gets its due recognition in the final estimate, a system of marking was introduced. To each character was allotted a maximum of 10 marks. Marks were given for the following field characters :— 1) Stand or germinating capacity ; 2) vigour or weight of yield ; 3) habit (straightness of canes — an important point) ; 4) tillering, *i. e.*, number of canes per stool.

A Table gives the marks obtained for the above four characters by each distributed seedling.

The sucrose contents in the different farms were estimated, but the figures are not yet strictly comparable, because of : 1) The smallness of the samples analysed ; 2) the unequal state of maturity of the samples ; 3) differences in the methods of analyses adopted.

The distribution of the selected material for trial purposes include the following localities : — Bangalore, Manjri, Tharsa, Pusa, Sepaya, Shajahanpore, Gurdaspur, Cawnpore, and Gwalior.

639 – **Studies and Observations on the Hybrids of the *Genus Citrus*.** — Trabut, L., in *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord*, Vol. X, No. 5, p. 89. Algiers, May 15, 1919.

For 20 years, the author has endeavoured to draw attention to a *Citrus* hybrid of the mandarin orange, which he named " Clementine ". The seeds from Clementine have produced Seville orange trees with very narrow leaves, mandarin orange trees with acid and bitter fruits, and orange trees of good quality. No precaution having been taken to avoid pollination from external sources, some of the these trees have originated from new crosses. At present, two of these hybrids can be preserved : the orange, good quality with highly coloured peel, juicy and with an agreeable smell ; and a small mandarin which the author proposes to call " Mandarinette. " The latter has a very pleasant smell, and is especially

suitable for confectionary, for which it may take rank with the "Chinese" and "Kumquat" varieties.

The seeds of "pomelo" have also given rise to a very varied progeny thus indicating that the pomelo is a hybrid of *Citrus grandis*; the author has obtained both *Citrus grandis* and orange trees from this hybrid. One of these orange trees resembled the American variety Pineapple. Another series consists of stock, bearing fruit similar in form and appearance to the Jaffa orange, but with very different leaves, many of which have a petiole with a big sheath like the pomelo.

These observations have shown that the seeds from these original hybrids can give rise to many new forms, some of which may be worth inclusion in orange plantations. In any case methodical crossing between the species of the genus *Citrus* will give new and interesting fruits in less time.

640 – **A New and Improved Variety of Plum obtained from a Bud Variation of the French "Petite Prune d'Agen", in California.** — SHAMEL, A. D., in *The Journal of Heredity*, Vol. X, No. 8, pp. 339-343; figs. 4. Washington, D. C., Nov. 1919.

The French plum (*Prunus domestica*) commonly called the "petite prune d'Agen" and cultivated on a vast scale in California, is noteworthy as a heavy bearer and for the excellent quality of the fruit, which however has the disadvantage of being somewhat small.

The production of a variety which, while retaining all the good points of the "petite prune d'Agen" can produce larger fruits, is consequently of considerable importance.

Good results have been obtained by a fruit grower, Mr. L. COATES, of Morganhill, California, who has succeeded in isolating some more or less distinct strains. In this paper the author describes one of these strains which originated from a bud variation and which promises to be the larger fruited variety so much sought after by plum producers. In 1904, in an orchard near Saratoga, Cal,. on a normal plum tree, COATES noticed one branch bearing very large fruits. The grafts secured from this branch gave plants which conserved the improvement in size, and at the same time possessed all of the desirable characteristics of the ordinary French plum. The new strain was called No. 1418.

In 1914, the No. 1418 (large fruited) and the ordinary plums (small fruited) were budded in alternate rows on about 1000 peach trees. The results furnish the basis for a fair comparison, as the yield of No. 1418 was more than double that of the parent variety; the fruit averaging about 25-30 to the pound, compared with 50-60 to the pound for the latter.

This new variety is not only remarkable for the size of the fruits, but also for the uniform distribution throughout the trees, which appear to be more vigorous growers and to develop larger leaves.

In studying the individual trees of No. 1418, several branches were occasionally found bearing fruits unmistakeably of the ordinary French type, which is additional evidence as to the origin of this bud variation.

At the present, in several localities, numerous experiments are in pro-

gress with a view to discovering the adaptability and possible area of distribution for this new variety of plum which should play an important part in fruit growing in California.

CEREALS AND PULSE CROPS

641 - **Spring Wheat on Southern Italy.** — CAMPBELL, C., in *Il Coltivatore*, Year LXVI No. 2, pp. 38-40. Casale Monferrato, Jan. 20, 1920.

The meteorological conditions in Southern Italy, always rainy in autumn, usually do not permit late sowings of wheat to be made, especially as the cold weather is not associated with snow and invariably includes a more or less lengthy period of frosts during which the plant not only stops growing, but also suffers from the direct action of the frost. These facts induced the author to attempt to cultivate spring wheat in the region in question, as the crop, towards the end of January and the beginning of February, can profit by the autumn cultivation of lupins or other leguminous plants as green manure, or used partly as forage and partly as green manure. There is thus the combined advantages of forage, green manure, and perhaps even compost, and also of avoiding the dangers associated with winter.

Following this system, successive wheat crops can be cultivated on the same land without danger, provided that between the two crops, comes the leguminous crop. The summer cultivation, even if only superficial, immediately after the harvest is sufficient to prepare the land for the leguminosae, when the first autumn rains begin.

The author's experiments lasted from 1905 to 1908. The trial with spring wheat in Northern Italy met with no success ; on the contrary, very encouraging results were obtained with Manitoba wheat (1).

In connection with the sowings made with Manitoba wheat, it should not be forgotten that for commercial purposes the Americans have classified this variety according to quality. Thus, Manitoba No. 1, has almost without exception an exposed ear possessing the ordinary qualities met with in spring wheat ; the other numbers are more or less a mixture of heterogeneous varieties amongst which those with exposed ear only constitute a small proportion.

This accounts for the unsuccessful results that Manitoba wheat has given and for the criticisms of its cultural qualities.

It had been hoped to discover a Red Fife in the Manitoba wheat. After due investigation the author has been led to believe that Manitoba No. I is no other than the Banatka wheat of Roumania and Ukraine, where it is cultivated as spring wheat The variety has probably been transported to America and cultivated there in a more or less pure state, gradually taking the place of the commercial product known under the name of Manitoba.

(1) With reference to Manitoba wheat in Canada and trials with this wheat in Italy, France and North Africa, see original article by M. L. H. NEWMANN, " Wheat production in Canada " in *R.*, July, 1917, pp. 961-967 and *R.*, April, 1917, No. 326 ; *R.*, Nov., 1917, No. 1017 ; *R.*, Jan., 1918, No. 34 ; *R.*, Sept., 1918, Nos. 978 and 1051 ; *R.*, Nov., 1918, No. 1230 ; *R.*, Dec., 1918, No. 1349 ; *R.*, Jan., 1919, No. 39 ; *R.*, Mar., 1919, No. 311 ; *R.*, May, 1919, No. 590. (*Ed.*)

After giving up work with the spring wheat varieties of the north, and having demonstrated that in actual practice, these cannot be adapted to southern climatical conditions, the author studied Manitoba comparatively with Apulian spring wheat („ Marzuolo di Puglia,„ "Marzulli") and the "Triminia„ from Sicily. These three varieties have proved themselves of good quality, but, although the productivity of the two first has not declined, the wheat from Apulia has given an inferior yield. During the author's experiments, the yield from spring wheats has kept fairly regular, and scarcely any noticeable difference has been found between this and the yield from the local autumn-sown wheats.

The question is whether it is advisable to extend the cultivation of spring wheat in Southern Italy in preference to the present uncertain production of maize. The author considers that this may be answered in the affimative, provided that the summer work on the stubble is not overlooked.

642 – **Mechanical Cultivation of Rice; The Gray Tractor with One Driving Wheel of The American Tractor Co.** — See No. 686 of this *Review*.

643 – **Preliminary Report on the Acclimatisation of Alfalfa in the Philippines.** — ELAYDA, I., in *The Philippine Agriculturist*, Vol. VIII, No. 3, pp. 10-76, pl. 1. Los Baños, Oct. 1919. FORAGE CROPS MEADOWS AND PASTURES

As alfalfa is reported to be under cultivation in Hawai, a tropical country it seems probable that suitable conditions may be found also for its growth in the Philippines, and several trials have been made in different localities.

The results as a whole indicate that the seed germinates well, and the plants cover the ground well, 2 or 3 cuttings may be expected, after which the plants will wither and die off. Where the land is limed and inoculation secured, the plants will grow during the dry season, but die out in the rainy season. The College of Agriculture, University of the Philippines, Los Baños, conducted several tests in 1917, on the cultivation of alfalfa varieties from seeds received from Minnesota, New York State, California, Arizona and India (Poona). The most encouraging results were obtained with the Indian variety. Seeds sown on December 12, 1918, germinated 2 days after. The flowering period began on February 5, 1919, and pods began to form on February 20. Mature pods were first harvested on April 8, and by May 28, flowers and fruits were still in developing. At the beginning of April, the lowest plants measured from 43 to 52 cm., and the highest from 100 to 118 cm. The fact that this variety produced, in the Philippines, seeds that were plump and bright yellow in colour (two main characteristics of good alfalfa seeds), encourages the hope that this forage crop may be acclimatised and improved with profit to the Philippines.

644 – **An Experiment on Thinning out Old Hevea Trees, in Java.** — CRAMER, P. J. S., in *The Tropical Agriculturist, Journal of the Ceylon Agricultural Society*, Vol. LIII, No. 5, pp. 299-304. Peradeniya, Ceylon, Nov., 1919. RUBBER GUM AND RESIN PLANTS

In the Government Experiment Garden for coffee at Bangelan (East Java), a field of coffee was planted with Hevea in 1901, to try this plant as a shade tree; the coffee was planted 7 × 7 feet, the rubber at 21 × 21 feet.

From natural causes, a few trees died out and, when the author examined the trees for the first time in 1915, 57 trees were left. These were 14 years old and had developed into high thick trees ; the growth was quite satisfactory, taking into account that the field was situated 1 800 feet above sea level. Up till then they had never been tapped.

Table I gives an idea of the distribution of the trees on the field.

TABLE I. — *Plan of the trees.* *

	51	**52**	53	**54**	55	56	**57**
50	49	48	47	**46**	**45**	44	**43**
	37	38	**39**	**40**	**41**	42	
36	**35**	**34**	33	32	31		**30**
22	23	**24**	25	26	**27**	**28**	29
	21	20	**19**	18	17	16	**15**
8	**9**		10	11	**12**	13	14
	7	**6**	5	**4**	3	**2**	**1**

* The numbers in thick type were kept on thinning out. Distance between the trees is 21 × 21 feet.

1) PRODUCTION IN 1918. — In 1918 tapping was begun. From January till May, the trees were tapped with two cuts on ¼ of the girth, left side ; at first on alternate days, then, after April 15, every day. The total number of tapping per tree was 59.

TABLE II. — *Production of Rubber in* 1918.

N° of Tree	Production in gm.	N° of tree	Production in gm.	N° of tree	Production in gm.
1	1962	20	650	39	1485
2	2005	21	1172	40	1786
3	512	22	1240	41	1078
4	2036	23	1177	42	744
5	874	24	1700	43	2983
6	1750	25	645	44	551
7	515	26	567	45	1992
8	690	27	1587	46	1929
9	2652	28	2413	47	862
10	895	29	760	48	613
11	520	30	830	49	1570
12	2235	31	543	50	705
13	1279	32	717	51	1495
14	754	33	860	52	1940
15	2894	34	1874	53	617
16	1380	35	1585	54	1390
17	1185	36	1602	55	868
18	1160	37	1432	56	2185
19	1323	38	552	57	2471

The total production of 57 trees was 75,791 kg.

The rubber was cured by the Brazilian process, coagulating the latex on a stick by smoke. By this means, it was possible to ascertain the individual production of each of the 57 trees numbered; the stick serving every day of the tapping process for the same tree, one ball of coagulated rubber being obtained for each tree.

The production is shown in Table II.

2) The proportion contributed by good and poor producers to the total crop (1918). — The poorest tree (No. 3) amongst the 57 Heveas in 1918, gave 512 grams of dry rubber, and the best one (No. 43), 2983 grams. The average production of each tree was 1328 grams.

In Table III the trees are arranged in groups according to their individual production in lots of 300 grams, and these groups are divided into 2 parts by a line at about the average production (1328 gm).

Table III. — *Grouping of trees according to production.*

Individual production of dry rubber	No. of trees in the group		Total production of the group	
0 — 300 kg	—		—	
301 — 600 »	7 trees	28	3 760 kg	21.616 kg
601 — 900 »	16 »		12 084 »	
901 — 1200 »	5 »		5 772 »	
1201 — 1500 »	8 trees	29	11 024 »	54.175 kg
1501 — 1800 »	7 »		11 580 »	
1801 — 2100 »	7 »		13 738 »	
2101 — 2400 »	2 »		4 420 »	
2401 — 2700 »	3 »		7 536 »	
2701 — 3000 »	2 »		5 877 »	

It is evident, then, that the 28 poorest trees gave production of 300-1200 gm., that is to say, 49 % of the trees gave 28.5 % of the total crop, and that the 29 best trees, *i. e.*, the remaining 51 %, gave 71. 5 %. If the trees are divided into two equal groups, the poor group will contribute only 30 % to the total crop, and the good group 70 %.

By proper thinning out, the soil, air, moisture, and plant food that was previously wasted on poor trees can be used to better advantage for the good trees. The results of such thinning will be considered later.

3) Influence of external conditions (particularly the space occupied). — The author divided the trees into 4 groups according to the space occupied : *a*) Closed in ; *b*) one side free ; *c*) two sides free ; *d*) three sides free (see Table I). Comparison between the total production of each group led the author to conclude that the differences observed with the individual productions are chiefly caused by the initial character of the trees, and only to a small extent by the external conditions, the production

in general being somewhat higher, if the trees have more space at their disposal (1).

4) Production after thinning out. — In July, 1918, half of the trees was cut out (see Table I) ; only the best producers were kept, regardless of the question of spacing ; one good tree was cut by mistake, and tree No. 4, which suffered from bark disease was not tapped in 1919. The remaining trees, 23 in number, and all with high yields, underwent 59 tappings, just as in 1918 ; but, whilst in 1918 they were tapped almost all the time on alternate days, in 1919 it was a case of every day tapping. It is well-known that with alternate days, tapping with the same number of taps gives a higher yield than with every day tapping : in spite of this, in 1919 the production was superior to that of 1918, as shown in Table IV. In this Table, the signs + and — are employed to signify the trees above or below the average production.

The increase of total yield for trees after thinning is remarkable, the average production per tree rose from 1830 gm. in 1918 to 2403 gm. in 1919, and this, as previously mentioned, in spite of the less advantageous method of tapping.

Comparing the trees individually in 1918 and 1919, it is obvious that, as general rule, the trees kept their position well ; an exception is tree No. 27, but here again the differences from the averages are only small. For example, No. 2 is in both cases a little above the average ; Nos. 15 and 43, both high producers in 1918 (about $^8/_2$ of the average) remained the best producers in 1919, with about the same proportion ; the poorest tree before the thinning out, No. 30, was also the poorest afterwards.

These figures show that the relative production of the trees remains constant ; it is a further argument showing that the special character of the tree is more responsible for its individual production than the external factors such as spacing etc. By dividing the trees into two groups : 1) those with space slightly widened by thinning : 2) Those with space much widened (see Table I), the author still further strengthens the force of the argument.

5) Conclusions. — The number of trees experimented with was not sufficient to allow further investigation, but the experiment demonstrates that production can be stimulated by thinning out, which is certainly one of the most important problems in rubber growing at present. But the most marked influence on production is the initial character of the trees (2).

(1) As regards the spacing of trees and influence on crop, see M. Girard's work on this subject ; see *R.*, Febr., 1919, No. 205, VI. (*Ed.*)

(2) Hence the considerable interest aroused in connection with the question of seed selection and new studies on grafting : see *R.*, Febr., 1920, No 194, and No. 645 of this *R.* (*Ed.*)

N° of tree	Production in 1918 January to April inclusive. 59 tappings	Production in 1919 March and April. 59 tappings
1	+ 1962 gm.	+ 3530 gm.
2	+ 2005	+ 2590
6	— 1750	— 1970
9	+ 2652	+ 3190
2	+ 2235	+ 2700
5	+ 2894	+ 3570
7	— 1185	— 1550
9	— 1323	— 1770
4	— 1700	— 2100
7	— 1587	+ 2680
8	+ 2413	+ 2920
0	— 830	— 1290
4	+ 1874	+ 2600
5	— 1585	— 2400
6	— 1602	— 2050
7	— 1432	— 1760
9	— 1485	— 1500
0	— 1786	— 2200
1	— 1078	— 1500
3	+ 2983	+ 3710
5	+ 1992	+ 2904
6	+ 1929	+ 2540
1	— 1495	— 1880
2	+ 1940	+ 3070
4	— 1390	— 1950
7	+ 2471	+ 2510
Total: **26** trees	*Average per tree*: **1830** gm.	*Average per tree*: **2403** gm.

45 – **The Grafting of Rubber.** — *The Tropical Agriculturist, Journal of the Ceylon Agricultural Society.* Vol. LIII, No. 5, pp. 297-298, Peradeniya, Ceylon, Nov., 1919.

The attention of most rubber growers has been directed to the possibility of securing increased yields per acre. The possibility of seed selection has been considered, and on many estates seeds from selected trees have been sown in the young clearings (1).

Similarly, the Ceylon Department of Agriculture has made special plantings from the No. 2 Heneratgota tree, and will in 1920 have areas ready for tapping.

With a knowledge of the differences in yields of individual trees, and to avoid cross pollination between good and poor trees (2), certain estates have made use of this information when thinning operations have been undertaken. The poorer trees have as far as possible been removed, and the better one allowed to remain.

A brief survey is made of experiments conducted in the Federated Malay States and in Java in connection with seed selection, budding and

(1) and (2) See *R.*, Feb., 1920, No. 194. I and II. (*Ed.*)

grafting (1), with a view to securing increased yields. Sufficient evidence has been secured to warrant the trial of these methods in Ceylon, where the rubber industry may yet see extensive areas of plants thus treated, set out. The experimental stage has, however, not yet been passed, and it has yet to be demonstrated that these systems can be generally adopted.

Trials should, however, be made with a view to securing definite information. Not only should the trials be made on young stumps, but the question might also be investigated as to whether grafts cannot be made on the old stumps of the poorer yielders, which for certain reasons it may not be desirable to remove. It is intended to make some trials on rubber estates in Peradeniya, Ceylon, in order to gain experience in regard to the methods best suited to local conditions, and it is possible that grafts could be supplied from No. 2 tree, if required.

646 - **Italian Camphor** (2). — CAVARA, F., in *Rivista italiana delle Essenze e Profumi*, Year II, No. 2, pp. 13-17, Figs. 2. Milan, Feb. 1920.

Prof. F. CAVARA, Director of the Royal Botanic Gardens, Naples, points out the importance af camphor production, especially with regard to Italy, and demonstrates the possibility and advantage of obtaining native supplies, laying special stress on the work by Prof. Italo GIGLIOLI, *La Canfora Italiana* (Rome, 1908). This work is amply provided with data bearing on matters connected with the history, industry, trade, geographical distribution, cultivation and acclimatisation of camphor (*Laurus Camphora* = *Cinnamomum Camphora*). Original work by Prof. GIGLIOLI himself is also included, dealing with the productivity of camphor and camphor oil of plants grown in various parts of Italy.

In Italy, examples of complete acclimatisation of *Laurus Camphora* are frequent ; for example in Naples (Botanic Gardens) and its environs (Capodimonte, Portici), at Caserta (Royal Park), and Rome, Pisa, Florence, on the Riviera, on Lake Maggiore (Isola Bella), etc. Formerly camphor was almost exclusively employed in pharmacy, but now, the pharmaceutical applications absorb only ¼ of the total production, whilst the remaining ¾ are utilised in various industries, 70 % of the total production being employed in the celluloid industry and in the manufacture of miscellaneous disinfectants, insecticides and gun-cotton. The wood on the other hand, is much sought after for sculpture and cabinet work.

Prof. GIGLIOLI recommends the use of the leaves, either green or dried, which fall off the trees when the new foliage pushes forward, for the extraction of camphor.

The utilisation of the small branches and leaves has introduced an innovation into the ordinary method of cultivation, and has been adopted in the United States and in Ceylon where the bushes are planted 6 ½ ft. apart, making 2500 bushes per hectare, which bear leaves only after some

(1) See R. Feb., 1920 No. 194. I and II (*Ed*).

(2) With regard to the actual state of camphor production in the world and the trial tests with camphor trees, see *R.*, May, 1920. No. 528. (*Ed.*)

ears. The leaves and branches on plants 10 years old have also been utised on new camphor plantations in Japan. Also in Jamaica, East and West Indies, and Malay Archipelago, and in British E. Africa, the green or dry leaves on young camphor plantations have been used.

The analytical investigations made by Prof. GIGLIOLI show that the yield from Italian camphor leaves is higher than that obtained elsewhere. This fact has been confirmed by GILDEMEISTER in *Les huiles essentielles* (French translation, 1914), and the following data are given :—

Percentage of Camphor furnished by Leaves and Branches in Various Countries.

Country	Analyst	Material analysed	Camphor %
Ceylon	Willis and Bamber	Leaves and branches	1
East Indies	Hooper	Leaves and branches	1
West Indies	Watts and Tempany	Green leaves	1.2 to 1.5
Jamaica	Emerson and Weidlein	Dry leaves	1.57
East Africa	Lommel	Dry leaves	1.55
Malay Archipelago	Eaton	Green leaves	1.17 to 1.2
Malay Archipelago	Eaton	Air dried leaves	1.10 to 1.16
United States	Hood and True	Dry leaves	2
Italy	Giglioli	Green leaves	1.2 to 1.5
Italy	Giglioli	Dry leaves	2.4 to 3

On the other hand, the yield from the other portions of the plant (branches, trunk, roots), is much less than that from Japanese camphor. Prof. GIGLIOLI obtained only 10 % from the trunk of the Italian trees compared with 1 % obtained from trunk slivers in Japan.

The large proportion of camphor in the dry Italian leaves may perhaps be due not only to the low water content in the leaves, but also to the accelerated oxidation of the oil of camphor during the later stages of growth. This is consistent with the investigations made by YOSHIDA in 1885 on oil of camphor and on camphor formation.

The lower camphor content in the trunk of the Italian tree compared with the Japanese, may perhaps be attributed to the different elaboration that takes place in the cells of young plants compared with fully developed or old plants, rather than to the difference in climate. In the first case there is a bigger formation of camphor oil ; in the second, there is more camphor. The relative amounts vary according to the organs of the plant, and with the changing seasons ; thus, in winter, there is a larger proportion of camphor, and in summer, the production of camphor oil, is greater. Out of 100 parts extracted by distillation of leaves of the Italian camphor plant, about ⅓ is camphor oil.

It has been stated that if, owing to the low seed production from the big trees acclimatised in Europe, the Japanese seed is sought after, there is a distinct risk of very feeble germination, either because the germinating

power, does not cover a long period and does not last out over the long voyage, or because when sent, they are neither fresh nor good.

Prof. CAVARA hopes to be able to confirm these statements, having received seed from Japan (from the Yokohama Nursery) on several occasions, that germinated well, gave vigorous seedlings, and developed extraordinarily well in a few years' time.

From sowings made in the Royal Botanic Gardens at Naples 3 years ago, a plantation of camphor plants was established to test the value of *Laurus Camphora* grown in a copse, with the idea of carefully using the leaves and branches for the extraction of camphor and camphor oil.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

647 – **The Cacao Industry in the Gold Coast and in the French Colonies and the Former German Colonies in Equatorial Africa.** — Report by Mr. TUDHOPE (Director of Agriculture, Gold Coast), followed by a note by M. LUC (Director of Agriculture in the French Colonies); Translation, preface, and conclusion by M. G. CAPUS, in the *Union Coloniale Française*, Publication du Comité d'Action Agricole Coloniale, Pt. I, pp. 37. Paris, 1919.

Mr. W. S. D. TUDHOPE presented his report to the third International Congress of Tropical Agriculture held in London in 1914. A complete translation together with notes by MM. LUC and CAPUS, is given in the publication under review and these two writers extract the points of interest to the French colonies and the former German colonies in Equatorial Africa. The chief conclusions are given below :—

(1) The production of cacao in the Gold Coast is an absolutely native industry and owes nothing to the European planter. Cacao was first exported from the Gold Coast in 1891, when, according to official statistics, the export was 80 lb., valued at £4. In 1913, the export amounted to 113 239 980 lb., valued at £2 489 218. The appended figures, quoted from official statistics, shew the development of the industry :—

Years	Quantities		Values		Quinquennal increase	
	Lb.	Kg.	£.	Fr.	£.	Fr.
1891	80	36	4	100	—	—
1896	86 745	39 839	2 276	56 900	2 272	56 800
1901	2 195 571	985 692	42 837	1 070 925	40 561	1 014 025
1906	20 104 504	9 117 393	336 269	8 406 725	293 432	7 335 800
1911	88 987 324	40 355 752	1 613 468	40 336 700	1 277 199	31 939 950
1913	113 239 980	51 354 331	2 489 218	62 230 450	875 750 in 2 years	21 893 750

Since 1913, the cacao production in the Gold Coast shows a progressive increase. In 1915, the export was 77 378 tons worth 91 302 250 fr., and in 1916, 72 128 t., worth 96 152 250 fr. Owing to the war and the scarcity of freight, part of the 1916 crop had to be stored by the traders and, at the end of the season, no business was done in the interior regions. In his report for 1916 the Director of Agriculture of the Gold Coast attributes a beneficial influence to this lack of a market, which, though due to tempo-

ry causes, none the less shows the danger of developing cacao as the le crop in the region, as both natives and Europeans neglect spontaneous oducts such as rubber and palm nuts, and even food products for local nsumption.

At present the Gold Coast is the largest producer of cacao in the orld, the whole output being due to the natives.

(2) The soil and climatic conditions are much the same as those of ie French colonies of Gabon, Dahomey, and especially, the Ivory Coast.

(3) The British administration has developed cacao growing by aking use of the favourable disposition of the educated natives and their esire for better conditions of life, and by buyng the crops at good prices hen they were not at a stage of interest to traders.

(4) The British administration then concentrated its efforts on ie increase of the native plantations, the improvement in the quality f the fermented and dried product, and on the diffusion of practical agri-ultural education amongst the natives.

(5) After this the traders began to buy and the product became a industrial commodity.

Thanks to the methods used, the export of cacao from the British old Coast increased from 39 000 to 51 000 tons, between 1896 and 1913 (1), hereas in the case of the French colonies of Gabon and the Ivory Coast, ie former only exported 155 tons in 1913 and the latter 47 tons. It is herefore important to ascertain how far the example given by the English an be followed elsewhere. The natural production from the Gabon entirely due to European cultivation, but the capital invested was xtremely small and the exports, in spite of their steady increase, have ot attained a large figure. The work done by the Germans in the Ca-eroons will thus be of interest in enabling an opinion to be formed as o whether a greater financial effort would give results comparable with ose obtained by the natives in the Gold Coast ; this is shown in the ppended table.

Comparative export (in tons) from the Gold Coast, Gabon, Cameroons, and the Ivory Coast.

Years	Gold Coast	Gabon	Cameroons	Ivory Coast	
				Years	Tons
896.	39	5	133	1900. . . .	—
901.	985	44	528	1905. . . .	2
906.	9 117	89	1 247	1910. . . .	7
911.	40 335	108	3 431	1913. . . .	47
918.	81 354	155	—	1915. . . .	114

(1) The exports amounted to 92 000 tons in 1917, according to the *Agricultural New* f April, 1919. (*Note by* M. Luc.)

These figures show that the progress in the German exports does not show a proportionately higher rate than that for the Gabon. Yet, the agricultural enterprises in the Cameroons cannot be reproached with lack of interprise, as capital, concessions, technical assistance from the official organisation of the local Government, labour (unscrupulous methods of recruiting black labour), none of these were wanting. Considering all the advantages that they had, it must be admitted that the German results were unsatisfactory : heavy expenses and low yields, and slow progress in the export trade.

Whilst the English, however, increased their production at little expense in 10 years from 985 to 40 335 tons, that of the Cameroons, during the same 10 years and in spite of a considerable financial effort, rose from 528 to 3431 tons only. The obvious reflection is whether the English method is not the best for Africa.

It is true that the example of San Thomé can be quoted in favour of European cultivation, but the cacao question there is not the same as in the coastal colonies on the Gulf of Guinea. According to M. A. CHEVALIER (1), the island of San Thomé is of volcanic origin and all the soils, almost exclusively formed by eruptions, consist of basalts, trachites and phonoliths, rocks which have weathered down to form the fertile soils of the island. These formations are extremely rare on the continent, practically all the soils in the Gabon and Ivory Coast being derived from the decomposition of crystalline rocks, such as granites, mica schists and metamorphic rocks ; they are far from being as fertile as those of San Thomé. It thus follows that the methods of cultivation — of decidedly special nature — in use in the Portuguese colony could not be applied in entirety on the continent, where similar soils are not to be found.

As the example of San Thomé is not applicable, the conditions of cacao cultivation by natives and Europeans must be examined comparatively. Mr. TUDHOPE gives valuable information regarding the Gold Coast, and states that the method of cultivation, as developed by the natives represents the *minimum of effort and expense.* The forest is only partly cleared, all the big trees being left standing, and the seed-beds are confined to nurseries situated in damp alluvial soils by watercourses, replanting generally taking place in competition with food plants such as the banana (*Musa*) and taro (*Colocasia*). In this way, the young plants enjoy good conditions for rooting, as the necessary shade is provided. The cultivation given to these crops, usually consisting in cutting the weeds with a bellhook or hoe, is of equal benefit to the cacao trees and helps them to come on well for the first 3 or 4 years. The cacao trees are usually planted very closely, and the natives prefer dense, straight trees forming a crown at a height of 7 ft., 6 in or. more. The area planted by each family is very small and does not produce more than 2 tons of cacao each year on an average. Thus, the whole production of the Gold Coast is the sum

(1) *Le Cacaoyer dans l'Ouest Africain*, by A. CHEVALIER, p. 245. Published by Challamel, Paris, 1908. (*Note by M.* LUC.)

of the output of a multiplicity of small village plantations, of small family crops, disseminated in a belt of plantations covering nearly 61 000 sq.km. These are special conditions, that cannot be duplicated in European plantations, requiring as they do the cultivation of vast surfaces within a limited radius. The natives pay but little attention to their plantations.

Mr. TUDHOPE is obviously forced to regard the native methods of cultivation as defective, as they are evidently the chief cause of the inferiority of the product :— Small capsules, atrophied seeds, bad fermentation ; but he has no need to worry about the extension of the crop, as the natives have become accustomed to grow it. His task at present consists chiefly in improving the quality of the product and, consequently, the primitive methods of cultivation, harvest, and fermentation. He sees all the disadvantages of the native methods, without ascertaining whether they have any compensatory advantages.

Mr. LUC differs from Mr. TUDHOPE on this point. The same stage has not been arrived at on the French coast, there is no production to improve, there is even no production. A large quantity must be produced above all, even if not first-class quality. Under these conditions, the simple native method will be seen to have the following advantages :

(1) Cultivated on small areas, near and around the villages, the young cacao plant benefits from the shade plants grown for food and from the manuring provided by household refuse.

(2) The native method carries out the principle of close planting and much can be said for this ; it is a point that must be insisted on. Whoever has visited abandoned cacao plantations will know that the old nurseries have persisted, *natural selection* having taken place, the weak yielding to the strong, which become more and more interlaced and seem to obtain through their common effort the faculty of resistance to disease and the invasion of the brush.

The native plantations are much on the same plan. Planted at 8 ft., 6 ½ ft., apart and even less, the trees rapidly cover the soil, the foliage interlaces and, when one tree dies, the vacant space is immediately occupied by adjacent trees. At Fernando-Po M. LUC has counted as many as 2500 or 3000 trees per hectare in native plantations, with an annual production amounting to 2 tons of prepared cocoa. This kind of plantation is probably very similar to that found in the Gold Coast.

(3) By their distribution through a vast forest region, the multitudes of small plantations are isolated one from another; they benefit from the shelter of the surrounding forest, from the constant humidity of the air, and the risk of the spread of fungoid disease, which has caused so many failures in extensive cultivation, is considerably reduced.

(4) The high cost of digging holes, planting, and replacing dead trees, estimated by M. LUC, at least 30 % in Gabon (1) during the

(1) At San Thomé, replacing is estimated at 30 % for the first year, 15 % for the second, 6 % for the third, and 2 % for the fourth (CHEVALIER). In Gabon, the losses are highest between the third and fourth years. (*Note by* M. LUC.)

first six years on European plantations, is quite insignificant for the native crop.

(5) Finally, the difficult problem of providing the fixed labour necessary for large plantations has not to be considered. It is partly solved by cultivation by families, chiefly by the women and children.

The principles of European cultivation are very different. So as to restrict the European staff required for management and supervision as much as possible, the plantations have to be grouped together, so that a considerable area of forest has to be cleared. The cacao plant does not do well in mediocre soils, in vast denuded surfaces. The nurseries are established in land carefully prepared and frequently manured ; the seeds are selected and, from germination onwards, the plants are watched and cared for, and as weakly plants differ little from strong ones, the selection is artificial.

The plants, after being transplanted and placed at distances usually 11.4 to 13 ft., apart, are often growing in a less fertile soil than that of the nursery. They have to live under these conditions for 5 to 6 years or more, before their foliage touches, which is necessary in practice to ensure the success of a plantation, and to which the planters rightly attach great importance.

These disadvantages do not occur in close plantations and it is possible that where cacao is grown like a replanted forest with successive thinnings, better financial results might be obtained in French Equatorial Africa.

M. Luc does not condemn European planting such as it is, but merely points out that the expenditure it requires in mediocre soils is not compensated for in most cases by the returns. He thinks it would be advisable to procede in the direction of the plantation that costs less, is planted more closely and contains varieties that quickly produce high yields.

The cacao grown in the Gold Coast is exclusively of the oval "forastero" type of the Amelonado variety, and its beans require a longer fermentation that those of almost any other variety. As this variety is both robust and prolific, M. Tudhope concludes that it is particularly well suited to the conditions prevailing in the Gold Coast, and that it was fortunate that this variety should have been the first to be introduced. Other types or varieties are being tested at the Government experimental stations but, with one exception (a hybrid of spontaneous origin), none of them appears to be as prolific or profitable as the ordinary type. The new variety, called Cundeamor by M. Tudhope, on account of its superficial resemblance to the Ceylonese type of the same name, is apparently prolific and produces much larger beans which are of superior quality. The natives appreciate this variety which, in time, will be planted over considerable areas. The slowness of its fermentation is of slight importance, as the natives prefer slow tasks.

Mr. Tudhope states that, in the Gold Coast, the cacao plant yields a fine crop 3 or 4 years after planting and quotes, as an average yield at Aburi, the extraordinarily high figure of nearly 8 lb. of dry cacao per tree, a yield which is equalled if not surpassed on certain native plantations in

ertile districts. A yield of 4.42 lb., per tree can be obtained in the Gabon n close plantations; in 1914, the ARMOR plantation included 15 000 adult rees and produced 34.5 tons.

Some of the South American varieties introduced into Africa fruit bundantly in their fourth year. The yield of seeds may also vary in number nd weight (1). The search for varieties that quickly produce high yields, n spite of their rapid exhaustion, becomes indispensable when they are ot required as the main subject of a plantation.

It seems that the soil and labour conditions in the French colonies n Equatorial Africa are not sufficient to ensure the success of vast agricul- ural enterprises whose sole aim is to produce cacao. The crop, however, would be both interesting and profitable considered as a complementary rop on the farm, provided that the best soils, and only these, vere reserved for it, and if the principle of close plantation were ollowed.

The conditions required for obtaining a large production in a short ime are apparently present in the Ivory Coast, and it would thus be ossible to make, with some chance of success, an effort similar to that vhich has given such convincing results in the Gold Coast. This, however, as been in progress since 1908, thanks to the initiative taken by the Go- ernor, M. ANGOULVANT, but by different methods, the chief of which is he obligation to plant.

The east coast of Madagascar seems equally well placed for a similar ttempt, with the advantage that the natives would be less refractory o French pressure.

But if these attempts are to be really useful and to lead rapidly to mportant productions, a considerable change will be required in the rench native policy. M. LUC does not say if this could be done without anger, but any method has its disadvantages and M. BAILLAUD, in his ook on *La politique indigène de l'Angleterre en Afrique occidentale*, points ut some of them. In this connection, the conclusions drawn by this uthor from a book by N. CASELY HAYFORD, a native lawyer of the Cape-Coast, will be of interest.

Mr. TUDHOPE does not seem very sure of the stability and security f this monoculture which has been taken up by the natives with such nthusiasm that they have completely neglected important sources of evenue such as rubber and the oil palm. In any case, it is evident that he policy followed in the Gold Coast has been the chief element in the uccess obtained in the production of cacao. It remains to be ascertain- d whether the principle can be applied to one or more of the French co- onies, and if so, whether the possibility of providing the French chocolate ndustry with its requirements would compensate for the disadvantages f the method under discussion.

(1) *Le cacaoyer au Congo français*, CHALEZ et LUC (p. 9 and on). Published by Challamel, Paris. (*Note by* M. LUC.)

648 – **The Wild Tea Plant of Phou-Sang, Tranninh Region, Upper Laos, Indo-China** (1). — MIÉVILLE, R., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 3, pp. 87-90. Saïgon, March, 1920.

This tea plant occurs wild in the wooded massif of Phou-Sang, Noung-Pek region. Phou-Sang is a large mountain group situated 60 km. in a straight line from Kiêng-Khouang ; it is 2300 m. high, and the wild tea plants only occur above an altitude of 1900 metres. There are two varieties of tea plant at Laos, one which is very common and gives rise to a certain amount of native trade, and one, a wild plant which is gradually disappearing and which is dealt with in the present article.

There are 280 plants of this species at the Tranninh Station, and, in 1917, 45 000 seeds were gathered from them, but none germinated. This was due to the fact that the native attendant gathered the first floral buds and used them after drying ; the last flowers left alone by the native were surprised by the first frosts and aborted.

In 1918 the 9000 seeds gathered were sown on October 30, and as the floral buds had been left untouched, these seeds were ripe on October 15. Germination began on October 20, 1919, and, by June 20, over 2000 plants had sprung up. The branches bore flowers only in the second year. It is estimated that, in normal seasons, the station could produce from 10 000 to 20 000 seeds of this tea plant each year. The station contains a plot of 400 sq. metres containing 148 Phou-Sang tea plants. The bushes, which were 3 or 4 m. high in 1919, were cut down to 1 m. above the ground ; numerous buds were produced and a first crop was obtained since 1918. Only young buds with slightly developed leaves were gathered. The harvest begun on April 10, 1918, ended on December 4 and produced a total of 23.565 kg. of dry tea, or an average of 160 gm. per plant. This yield is certainly smaller than that actually realised, for the coolies dishonestly retained part for themselves. Supposing 1 hectare were planted with Phou-Sang tea at 1.5 m. distance every way (distance necessary for the growth of the plants), there would be 5675 plants per hectare, and the corresponding crop would be 900 kg., of fine, prepared tea.

The following figures give, according to M. AUFRAY, the chemical analysis of samples provided by the author.

In 1903, the author had already tasted Phou-Sang tea, as a Chinese named AMOCK, who had become a French subject, had given him several samples, saying that it had come from the Imperial Chinese Court. M. AMOCK had informed him that the tea cost $20 to 24 (50 to 60 fr. at par) a Chinese pound (700 gm.), and the author learnt that Chinese preparers went each year to gather and prepare the buds of the precious species at the Phou-Sang mountain. When the Chinese arrived, the Meos showed them the trees they had found in the forest ; the Chinese then cut down the trees and gathered the young shoots which they prepared in their own way. The process consists in letting the shoots fade, then rolling the

(1) For information on the wild tea plants in India and China, see *R.*, April, 1920. No. 413. (*Ed.*)

	Fermented tea	Unfermented tea
Moisture	10.00 %	9.70 %
Nitrogenous matter	23.37	23.37
Fats	1.98	1.74
Tannin	13.25	13.75
Total ash	5.10	5.12
Soluble ash	2.02	2.14
Thein	2.35	3.70
Nitrogen	3.74	3.14
Matter soluble in boiling water	41.25	44.50

buds by hand and drying them in a large iron pot. The average crop each year from Phou-Sang was not more than 10-15 kg. of fine tea. The adult leaves were pressed while still green in large hollow bamboos and warmed over a flame, when the leaves were removed from the bamboo, dried in the pot and taken to China. If the Chinese went so far for such a small crop for the Emperor of China, it is because they valued it.

The Phou-Sang tea trees have almost disappeared and now the forest contains only scattered trunks cut down to 1 metre above the soil. The trunks send up new shoots every year, but they die for lack of air and light. It is fortunate for the preservation of this species that small plantations have been established at two stations. In fact, seed-bearing trees exist at the Na-Hoi station ; bought from a woman Pon-Ting who got them from Phou-Sang, they were planted in 1905 at 1 m. apart and have never been pruned. The author found them to be well grown, 5 to 6 m. high ; dug up in September, 1919, they were planted 5 m. apart, so as to form a new plantation of seed-bearers. The station now possesses 142 tea plants which, if cared for, could produce an abundant fructification by 1922. In addition, the 400 sq. m. plantation mentioned above was started by the native attendant who went with coolies to Phou-Sang to obtain young plants ; he brought back about 300, of which 148 are still living at the station.

649 – **The Effect of Fertilisers on the Combustibility of Tobacco.** — See No. 627 of this *Review*.

650 – **Coca Production and Trade in Java.** — De Wildeman, E., in *Bulletin Agricole de l'Institut Scientifique de Saïgon*, Year II, No. 5, pp. 79-80. Saïgon, March, 1920.

The cultivation of the coca plant was already widely spread in the Dutch East Indies, before the war ; very diverse opinions had been expressed as to its future as a crop, as it was threatened by the preparation of synthetic cocaine. All the same, several planters have extended the area under the crop, and factories, established in the Dutch East Indies, have done good business, possibly owing to the circumstances at that time.

The future of coca cannot be foreseen, and it will be useful to survey the progress of the production of the coca leaf, its trade and its consumption. Practically all the pre-war production went to Europe and, in

1916, Amsterdam was still one of the great centres for the product. In the appended table, the author indicates the reserves of coca leaves, in packages at Amsterdam ; the gradual depletion of the stocks is marked.

	1916	1917	1918
End of January	10 296	5 540	403
February	10 164	4 867	237
March	10 149	3 792	143
April	9 745	3 715	87
May	9 797	5 225	30
June	9 235	3 989	30
July	9 011	2 507	30
August	8 777	1 287	30
September	8 237	448	30
October	7 932	448	54
November	6 336	403	0
December	5 877	403	0

As the stocks diminished, the average unit price naturally increased ; in 1916 it was 14.45 cents and in 1917 it was 20.09 cents. In hand to hand buying, the differences in price varied from to 30 to 70 cents. In 1917, the export of coca leaves to Holland and the United Kingdom began to diminish, largely owing to the lack of tonnage, and, in 1918 export to Europe ceased completely, but as the appended figures show, the total export from Java increased not diminished.

Export of coca leaves from Java.

	1917 kg.	1918 kg.
Holland	17 043	—
United Kingdom	4 105	—
United States	151 601	282 555
Japan	6 423	211 629
	179 172	494 182

It will be seen that the consumption of the United States increase considerably from 1917 to 1918, but not to such an extent as that o Japan. The consumption of leaves by cocaine factories was thus ver large.

It will be of interest to see if these proportions will be maintaine or if, now the seas are free, the large export to Holland and the Unite Kingdom will be re-established. It is to be feared that, as the war ha displaced so many markets, Europe will find it difficult to recapture then

The factory established at Soekaldemi, Java, has regularly worked coca leaves, obtaining an extract with over 50 % of alkaloid.

The treatment of the raw material in the producing country should undoubtedly be encouraged, as it would procure a great benefit for the colony and its native inhabitans.

651 – **Mulberry Plantations** (1). — Bucci P., in the *Rivista di Ampelografia*, Year 1, No. 4, pp. 51-58. Alba-Leghorn, Feb. 15, 1920. VARIOUS CROPS

In 1914, the author established at the Torretta farm of the "R. Scuola Enologica," at Avellino, a mulberry plantation of an area of 240 sq. m., with 14 lines, of young mulberry trees at distances of 70 cm. between the lines and 40 cm. in the lines which works out at 35 700 trees per hectare. In spite of the close planting, the trees grew vigorously. The author has obtained the following data:

The cost of establishing and cultivating 1 *hectare of mulberry trees at Avellino.*

Interest on estate capital, considering the land as bare, but of first class type	200	
Expense of hoeing 35 cm. deep; 60 days to 3 fr.	180	
Tracing lines for the trees; 10 days at 3 fr.	30	
Planting the young trees; 20 days at 3 fr.	60	
Value of 35 700 young trees at 0.03 fr. each	1 071	
Weeding twice; 24 days at 3 fr.	72	
Estate tax	60	
General expenses at the rate of 5% of the preceding expenses, less interest on the estate capital	73.65	
Interest at 3 % on the capital represented by the preceding expenses, less interest on the estate capital	46.40	
Total	1 793.05	fr.
Interest on estate capital as in 1914	200	fr.
Weeding twice; 24 days at 3 fr.	72	
Replacing young or dying plants at the rate of 5 % of the number of trees; value of the young trees 53.55 fr.; 5 days at 3 fr.	68.55	
Gathering leaves as branches; 10 days (women) at 2 fr.	20	
Estate tax	60	
General expenses calculated as in 1914	11.05	
Interest at 3 % on the capital represented by the preceding expenses, less interest on the estate capital	6.95	
Total	438.55	fr.
Interest on estate capital as in 1914 and 1915	200	fr.
Weeding twice; 24 days at 3 fr.	72	
Gathering leaves as branches, 12 days (women) at 2 fr.	24	
Estate tax	60	

(1) See *R.*, Jan., 1916, No. 57. (*Ed.*)

General expenses calculated as above.	7.80
Interest at 3 % on the capital represented by the preceding expenses, less interest on the estate capital	4.90
Total . . .	368.70 fr.

Interest on estate capital as above.	200 fr.
Weeding twice; 24 days at 5 fr..	120
Gathering leaves as branches; 12 days (women) at 3 fr.	36
Estate tax	60
General expenses calculated as above.	20.80
Interest at 3 % on the capital represented by the preceding expenses, less interest on the estate capital	16.10
Total . . .	452.90 fr.

Interest on estate capital as above.	200 fr.
Weeding twice; 24 days at 7 fr..	168
Gathering leaves as branches; 12 days (women) at 3 fr.	36
Estate tax	60
General expenses calculated as above.	23.20
Interest at 3 % on the capital represented by the preceding expenses, less interest on the estate capital	14.60
Total	501.80 fr.

(Unless otherwise stated the working days mentioned above are those of a man).

If the expenses of the fifth year are assumed to be the same for the following five years, the total expenses for the ten-year period would be 7968.02 fr., which gives a constant annual expense of 625.40 fr.

In the branches (gathered in this way for rearing silkworms in the Friulan way), the pure leaf represented: — 44.39 % in weight in 1916; 46.71 % in 1917; and 41.58 % in 1918. If these coefficients are applied to the weight of leaf as branches actually gathered, the yields in pure leaves per hectare are: — 4499.209 kg. in 1916; 8819.876 kg. in 1917; 11 212.312 kg. in 1918; total, 24 531.397 kg.; annual average 8177.132 kg. It can be assumed that this average holds good for the other 5 years, because, though the production increased during the first 2 years, it decreased in the following years. From these figures, and valuing the leaf as branches at 15 fr. a quintal, the total value of leaf produced during the 10-year period would be 23 241.82 fr., which gives an annual constant value of the leaf of 1824.25 fr. The annual net return from the plantation is, therefore, 1824.25 fr. — 625.40 fr. = 1198.85 fr.

The leaf produced by one hectare of mulberry plantation will serve to rear at least 15 ounces (of 30 gm.) of silkworm eggs.

The author compares these data with others furnished by Prof. J. DI GADDO, director of the travelling chair of agriculture of the districts of Oderzo and Motta di Livenza (province of Treviso.) The latter considers

hat a mulberry plantation lasts 13 years and that, at the end of the 13th ear, the expenditure per hectare is 180 fr., to clear out the roots; he esti- nates the production of leaves in the different years of the duration of the plantation starting from the 2nd. year, at 70, 150, 300, 400, 450, 400, 400, 350, 300, 200, 150 quintals per hectare for each year, respectively; he constant annual value of the products (valuing the leaves at 6 fr. a quintal) at 1602.24 fr., and the constant annual expenditure at 825.30 fr- In respect of this estimate, the author observes that the mulberry planta. ion may last longer than M. DI GADDO admits, *i. e.*, 17 to 20 years instead of 13, and that the cost of removing the roots in the last year could be placed at a much more modest figure because it can, at any rate to a large extent, be debited to the grass crop that follows the mulberry plantation and for which it constitutes an excellent precursor in the rotation.

Prof. BUCCI gives detailed information on planting and on the care of the plantation, and he remarks that his experiments on the action of nitrogenous fertilisers, on the digestibility of the mulberry leaf, and on the influence of leaves from manured trees on the quantity and quality of the cocoons lead him to fear the use of quick-acting nitrogenous manures at the moment of planting if the leaves of the mulberries (as happens in the case of plantations) have to be removed after the second year. It is thus preferable to give a thorough application of farmyard manure at the rate of 200 quintals per hectare, together with at least 2 quintals of super- phosphate per hectare, or a good green manuring with some leguminous crop manured with superphosphate.

In years when the spring defoliation is carried out normally, the plant- cation can be treated with quick-acting fertilisers, preferably, ammonium sulphate or sodiun nitrate because, as the authors' experiments have shown, leaves from mulberries manured at the rate of 1 quintal of ammonium sulphate per hectare are more digestible than those from plantations that have received the same amount of nitrogen but in the form of nitrate of soda (*i. e.*, 130 kg., per hectare.)

The author also found that it was best to prune the young mulberries in the autumn, the same year as planting (carried out in spring), but care must be taken, both in the first and subsequent prunings, to leave a stump above ground and not cut the plants down to the ground, because, with a small trunk emerging, tillering is favoured, thus leading to the produc- tion of a greater number of branches and considerably increasing the quantity of leaves produced.

652 - ***Saccharum aegyptiacum* in the Dunes on the Algerian Littoral.** — LA- MOTTEDUCAMPS, in the *Bulletin agricole de l'Algérie-Tunisie-Maroc, Annales de l'Expé- rimentation agricole et de la Colonisation de l'Afrique du Nord*, Series 2, Years XXVI, Nos. 1-2, pp. 23-25. Algiers, Jan.-Feb., 1020.

Saccharum aegyptiacum, a common plant in Egypt, has long been used on the east coast of Sicily as a windbreak and grows wild near Bône. Following on the suggestion of the Botanical Service, the Algerian Forest Service has used it successfully for some years for binding dunes.

The author describes the results obtained from his plantations of *Saccharum* at Achachas, near Lapasset, in the department of Oran. Since it was imported in 1915, the plant has been used in three ways by the author as the estate was gradually formed. At first, cuttings were placed in the sand dunes which they were to fix and, in case of success, they constituted a kind of reserve nursery for subsequent use. This first plantation extended so considerably that it is now quite a *Saccharum* forest, certainly small but sufficiently high to hide a man on horseback and bushy enough to cover a herd of cattle.

The first paths on the estate were afterwards bordered with 2 rows of cuttings placed at a distance of 40 cm. in and between the rows ; the borders are now from 1.5 to 2 m. thick and have a very pleasant appearance They are easily kept in order and to prevent them extending too much it is sufficient to run the plough along close to them.

The third use is the chief and most satisfactory aim, *i. e.*, as a windbreak.

Thanks to *Saccharum*, the vineyard can easily be divided into long, parallel rectangles with a witch of 25 m. in the case of soils that are sandiest or most exposed to the wind, and of 50 m. in more compact and better-sheltered soils. These hedges grow very rapidly and form a very efficient windbreak. The vines are planted 1. m. apart in the rows and 2.5 m apart between the rows ; as soon as the vines are strong enough the windbreaks will be left only at regular intervals 50 m. apart. The sand, enriched by cultivation, will be less blown about and there will be less fear of scorching from it. For this reason, starting from the initial hedge, all the hedges placed 50 m. apart are permanent and replace a row of vines. The cuttings are planted at distances of 40 cm. apart. The hedges placed 25 m. apart are temporary and grow in the space between two rows ; as they have to exert their maximum effect as quickly as possible, they are planted more closely, *i, e.*, at distances of 30 cm. in every direction. Plantation took place in October in ground that still retained some moisture and in January and February after abundant rain in ordinary soil. Almost everywhere cuttings 80 cm. long were used and buried 40 cm. in the soil so that the wind, which is constantly shifting the level of the soil, always leaves the plant buried sufficiently ; 95 % of the plants struck roots. The young plant always develops at the eye placed at the level of the soil or slightly below it. When there are two shoots, the upper one is always weaker and, as a rule, all the upper part of the cutting, some 30 cm., dies.

The last plantations made in soils where the sand is fixed are cut level with the ground. A greater number of cuttings can be obtained with the same quantity of material and the young plants grow more quickly and better.

As the cuttings are planted in January, the young shoot grows in the spring and is 1.2 to 1.5 m. high at the end of the year. In the following spring, each plant forms a small tuft and the windbreak plays its part as soon as the vines begin to grow, for by then, the hedges are already close, and are 2. to 2.5 m. high at the end of the year.

The hedge increases in density and height during subsequent years. As there was no straw left in 1919, the leafy tips of the *Saccharum* were fed to horses, which ate them eagerly. The plant has given astounding results at Oued Kramis and should be propagated for estates exposed to the wind ; it ought to be better known.

653 – **Market-gardening in Italy.** — Séano. G., in *Il Coltivatore*, Year 66, No. 3, p. 66. Casale Monferrato, Jan. 30, 1920 ; No. 5, pp. 125-130, Feb. 20, 1920 ; No. 7, pp. 171-181, March, 10, 1920 ; No. 9, pp. 240-243, March 30, 1920. HORTICULTURE

Market-gardening in Italy occupies 111 000 hectares, of which 51 000 hectares are occupied by vegetables grown on a large scale and 60 000 by permanent market-gardens ; there are also 48 000 hectares of market-gardens in which fruit-growing is carried on. The 111 000 hectares mentioned represent barely 0.39 % of the whole area of the country, 42 % of the agricultural and forestal area, and 0.84 % of the arable land. Industrial horticulture, therefore, might play a much more important part in Italy than it does at present. The appended table shews the vegetables grown on a large scale and the area they occupied in Italy, in 1916-17, when the total area covered was 83 987 hectares.

Tomatoes	28 225 hectares	Onions and garlic	6 005 hectares
Fresh vegetables	23 565 »	Artichokes	5 775 »
Cabbages and cauliflowers.	9 090 »	Celery, cardoons, fennels .	2 025 »
Melons and water-melons.	8 510 »	Asparagus	792 »

The tomato, then, occupied 33 % of the total area employed for large-scale vegetable crops, and it is of most importance in the regions where tinned tomatoes are prepared, such as the province of Parma and parts of Sicily and Sardinia. The 83 987 hectares planted with large-scale vegetable crops were distributed as follows (in hectares) : — Northern Italy, 20 2670 ; central Italy, 9747 ; southern Italy, 42 610 (Campania 22 665, Apulia 18 470) ; islands 10 960. Market-gardening is, therefore, practised most in southern and insular Italy.

The author rapidly considers the extension of the different crops in each region during the period 1916-17, and gives the absolute and unit production. He desires to attract the farmers' attention to the question and to give him information that will lead him to start market-gardening in places where it is absent, or if present, to develop and improve it.

The different vegetable crops in the various regions of Italy and the area they occupied (in hectares) are given below : —

Piedmont : — Fresh vegetables 1100, cabbages and cauliflowers 1025 onions and garlic 255, asparagus 200, celery, cardoons, fennel 120, tomatoes 50.

Liguria : — Fresh vegetables 3700, tomatoes 1425, cabbages and

cauliflowers 1200, artichokes 475, celery, cardoons, fennel 250, asparagus 220.

Lombardy : — Melons and water-melons 510.

Venetia : — Onions and garlic 1950, fresh vegetables 410, cabbages and cauliflowers 590, artichokes 340, asparagus 300, tomatoes 190.

Emilia : — Tomatoes 5885, melons and water-melons 375, onions and garlic 170, celery, cardoons, fennel 130.

Tuscany : — Artichokes 1270, cabbages and cauliflowers, 555, tomatoes 510, onions and garlic 320, melons and water-melons 70.

Latium : — Artichokes 800, tomatoes 730, cabbages and cauliflowers 550, fresh vegetables 500, onions and garlic 450, celery, cardoons, fennel, 275, melons and water-melons 250, asparagus 75.

Abruzzi and Molise : — Fresh vegetables 2250, tomatoes 685, melons and water-melons 330, celery, cardoons, fennel 140.

Campania : — Tomatoes 8580, fresh vegetables 5250, cabbages and cauliflowers 3165, melons and water-melons 2635, onions and garlic 1720, artichokes 705, celery, cardoons, fennel 610.

Apulia : — Dry vegetables 7650, tomatoes 3935, melons and water-melons 3480, cabbages and cauliflowers 2205, onions and garlic 560, celery, cardoons, fennel 240.

Calabria : — Tomatoes 1200, fresh vegetables 275.

Sicily : — Tomatoes 3400, fresh vegetables 2430, artichokes 1145, melons and water-melons 515, onions and garlic 280, celery, cardoons fennel 100.

Sardinia : — Tomatoes 1645, artichokes, 800, melons and water melons 345, onions and garlic 300.

The percentage of market-garden crops compared with the area cultivated are, for each region : Cämpania 26.99, Apulia 21.99, Sicily, 9.37, Liguria 8.00, Emilia 7.81, Latium 4.23, Venetia 4.26, Abruzzi and Molise 4.05, Sardinia 3.68, Piedmont 3.27, Tuscany 3.23, Calabria 1.67, Lombardy 0.61. In the Marches, Umbria, and Basilicata large-scale vegetable crops are not grown.

The Italian production of vegetable during the agricultural year 1916-1917 amounted to 9771.9 metric tons, distributed in the following manner : —

	Metric tons		Metric tons
Tomatoes	4 316 50	Onions and garlic	657 50
Cabbages and cauliflowers	1 776 50	Artichokes	511 00
Melons and water-melons	1 286 50	Celery, cardoons, fennel	335 50
Fresh vegetables	862 50	Asparagus	25 90

In *Piedmont*, over a half of the total production (40 580 tons) consisted of cabbages and cauliflowers (23 500 t.) ; the remainder was : Fresh vegetables 8350 t., onions and garlic 4200 t., celery, cardoons, fennel 2350 t., tomatoes 1550 t., asparagus 630 t.

In *Liguria*, nearly half the total production (121 385 t.) consisted of tomatoes (56 800 t.); the remainder was: — Cabbages and cauliflowers 35 500 t., fresh vegetables 17 750 t., celery, cardoons, fennel 7750 t., artichokes 2700 t., asparagus 885 t.

Lombardy only produces melons and water-melons (6450 t.) as industrial garden crops.

In *Venetia*, the total production is 32 600 t; the first place is occupied by onions and garlic with 15 000 t., followed by cabbages and cauliflowers 8200 t., tomatoes 3800 t., fresh vegetables 2500 t., artichokes 2200 t., and asparagus 900 t. This region produces 34.75 % of the total production of asparagus in Italy.

In *Emilia*, the total production of 137 600 t. is distributed as follows: Tomatoes 125 800 t. (or 29.14 of the total Italian production), melons and water-melons 4900 t., onions and garlic 4550 t., celery, fennel, cardoons 2350 t.

In *Tuscany*, the total production is 41 500 t., the chief crops are artichokes (17 000 t., or 33.27 % of the Italian production) and cabbages and cauliflowers (12 750 t.); other crops include: —8100 t. of tomatoes, 2850 t. of onions and garlic, and 800 t. of melons and water-melons.

Latium, the total production is 36 225 t., including: — Tomatoes 11 810 t., cabbages and cauliflowers 7500 t., artichokes 5600 t., onions and garlic 4850 t., celery, cardoons and fennel 3000 t., melons and water-melons 2500 t., fresh vegetables 1000 t., asparagus 175 t.

In the *Abruzzi* and *Molise*, 16 550 t. of garden crops is produced including: — Tomatoes 8250 t., fresh vegetables 3850 t., melons and watermelons 2900 t., celery, cardoons and fennel 1550 t.

Campania has the highest production with 280 400 t., and in proportion to the whole Italian production, produces 44 % of the melons, 25.84 % of the cabbages and cauliflowers, 31.56 % of the onions and garlic, 28.17 % of the celery, cardoons and fennel. The figures are: — Tomatoes 121 650 t., melons 56 600 t., cabbages and cauliflowers 46 t., onions and garlic 20 750 t., fresh vegetables 19 150 t., celery, cardoons and fennel 9450 t., and artichokes 6900 t.

In *Apulia*, the total production (151 000 t.) comprises: Cabbages and cauliflowers 44 500 t., melons 43 250 t., tomatoes 28 200 t. fresh vegetables 10 900 t., onions and garlic 6 200 t., celery, cardoons, fennel 5100 t., and artichokes 3050 t.

In *Calabria*, the industrial production of garden crops is represented by 16 900 t. of tomatoes and 2550 t. of fresh vegetables.

In *Sicily*, with a total production of 64 950 t., there are: — Tomatoes 33 050 t., fresh vegetables 10 200 t. melons 7600 t., artichokes 7450 t., onion and garlic 4650 t., celery, cardoons and fennel 2000 t.

In conclusion, the total production of garden crops in *Sardinia* is 28 501 t., including: — Tomatoes 15 750 t., artichokes 6200, t., melons 350 t., and onions and garlic 2900 t.

The author deals with the various species of vegetables grown industrially in Italy.

Tomato. — This is the most important garden crop, and is grown over the largest area in southern Italy and the island, the first places being taken by Salerno, Parma, Naples, and Lecce. The chief absolute productions are, in descending order, in the provinces of Salerno, Parma, Naples, and Genoa. The average unit yield in Italy is 153 quintals per hectare' varying from a maximum of 399 quintals in Liguria and 310 quintals in Piedmont to a minimum of 72 quintals in Apulia.

Cabbage and cauliflower. — These cover 9090 hectares the total yield being 177 650 tons. The largest areas under these crops are in the provinces of Lecce Naples, and Salerno, and the highest yields are obtained in the provinces of Lecce, Naples, Turin and Bari. The average unit yield in Italy is 195 quintals per hectare with a maximum of 296 quintals in Liguria and a minimum of 145 in Campania and 135 in Latium.

Melons and water-melons. — These occupy 8510 hectares, which produce 12 8650 t. The provinces where these crops are most important are Lecce and Naples. The average unit yield in Italy is 151 quintals per hectare, varying from a maximum of 250 in Latium and a minimum of 88 in the Abruzzi and Molise.

Fresh vegetables. — These cover 83 565 hectares and yield 86 260 t., the largest areas of production being in the province of Naples, Lecce, and Bari ; those where the absolute production is highest are Naples, Bari, and Lecce. The average unit yield for the whole kingdom is 37 quintals per hectare, with a maximum of 93 quintals in Calabria and a minimum of 17 in the Abruzzi and Molise.

654 – **Grafting the Aubergine (*Solanum Melongena*) on *S. Schoenbrunnense*.** — De Gregorio, A., in the *Nuovi Annali di Agricoltura siciliana*, Series VI, Year VIII, Pt. 1, p. 27. Palermo, 1919.

Solanum Schoenbrunnense (syn. *sodomaeum*) is a Sicilian weed that grows vigorously, attaining almost double the height of the cultivated aubergine (*S. Melogena*). As it is perennial and not so exacting as the cultivated species, the author has used it as a grafting stock for the latter, with satisfactory results, even as regards the quality of the fruit produced.

FRUIT GROWING

655 – **Banana Cultivation and Trade in the Canary Islands.** — Padavera, in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year IV, 1919-1920, No. 28, pp. 110-113. Paris, Jan.-Feb., 1920.

Banana cultivation is progressing in the Canary Island, especially at Teneriffe and in the Grand Canary, the total area under the crop being from 2500 to 3000 hectares. The tendency of the plantations to expand is limited by the lack of water. The value of a hectare planted and in full bearing is about 80 000 fr., and the price of a banana stock is now 5 fr. In a banana plantation in full bearing, there are 1300 to 1500 plants per hectare yielding from 1600 to 2000 bunches a year.

The price per hectare of land suitable for banana growing varies between 30 000 and 50 000 fr., whilst 25 000 to 30 000 fr. are required to plant it, etc. The time required for a plantation to attain a good

oduction is from 2 to 3 years. To obtain an average production, two ars must elapse and it must be remembered that the first crop usually nsists of small or medium fruit. The production is normal at years.

The ordinary working expenses are from 5000 to 7000 fr. per hectare r annum, including the cost of manuring, watering, gathering, etc. he average quantity of irrigation water required is 12 000 cu. metres r hectare per annum; for the months from November to July 7000 u. metres is required and 5000 cu. m. for the months from July to Octo- er. The water comes from springs or from tunnels driven into the ountain to tap impermeable strata, or from large reservoirs formed by ams built between two mountains to retain the rain water. On an estate f 1 to 2 hectares, 2 men suffice to ensure irrigation throughout the year; ie day wage is 4 to 5 fr. The water is distributed by concrete channels, tilising the natural slope of the land; water is rarely raised. The ater required to irrigate 1 hectare costs from 1000 to 1600 fr. a year, ut this varies as most plantations own their water-rights. Owners who ave no water, or have not enough buy it by the day or the year at the price f 0.14 fr. per cu. metre, which gives annual cost of 1600 to 2100 fr. for rigation water.

Farmyard manure and fertilisers are used for improving the soil. he average composition of the fertiliser used in the island is as follows: ulphate of ammonia 35 %, superphosphate of lime or bones 35 %, sul- hate of potatsh (containing 48-50 % of soluble K_2O) 20 %, sulphate f iron 2 %, and gypsum 8-10 %.

The life of a banana plantation when well cared for and manured ppears to be almost without limits. The soil of the Canaries is of poor uality and as it is of volcanic origin, it requires to be supplemented with fertilisers, particularly nitrogen, phosphoric acid, and lime; the oil containg, naturally, a certain amount of potash.

The banana is considered to be the best crop in the island, especially s the sale of the fruit increases every year. Only fresh bananas are xported, but, during the war-time lack of shipping, large quantities of anana flour had to be made. Since a normal tonnage has become avail- ble, there has been no necessity to make the flour.

The full, green bananas are exported just when they require 20 days r so to ripen. Their chance of keeping and the methods to keep them s sound as possible depend on the cutting, the packing and the storage n board ship. The bunches of Canary bananas are of two classes, market- ble and suitable for export, and waste or unsuitable for export. The unches for export comprise at least 8 volutes or " hands " (8, 9, 10, 11, 11, 12, 13) and bunches with 7 hands or less are considered as waste. The saleable bunches are to day classified in the following way: —

1. — On the plantation, the price of the bare bunches is: — Giant 21 fr., extra 18 fr., firsts 12 fr., seconds 8 fr., and discarded bunches sell at 2 to 4 fr.

2. — On the quay, the prices are 28, 24, 18 and 15 fr., respectively.

Name of the bunches	Weight
Giant, with 250 fruits and over.	28 kg. and over
Extra, with 200 fruits and over	about 25 kg.
Firsts with 160 fruits and over.	20-22 kg.
Seconds, with 125 fruits and over.	12-20 kg.

3). — On the boat. — The above prices have to be increased by 0.50 fr. for loading on board ship.

On a good plantation, the discarded bunches are in the proportion of 6 to 10 %.

The bunches are packed in crates, at the rate of two bunches a crate, The crate costs 2.20 to 2.50 fr., labour 0.50 to 2.50 fr., wadding 0.60 fr. paper 0.25 fr., nails 0.25 fr., straw 0.60 to 1 fr., handcart for transport 0.20 to 0.50 fr. The total cost of the crate, packing, and transport to the quay is from 5 to 7 fr.

In the Canaries, the average cost of investing money, guaranteed by mortage, is usually 6 %.

The total export from the Canaries is probably over 4 million bunches a year, of which France takes just over a million and England about 3 million.

656 - **Researches on the Harvesting and Storage of Pears, carried out in the Rogue River Valley, Oregon, U. S. A.** — I. Lewis, C. J., Magness, J. R., and Cate, C. C., in the *Oregon Agricultural College Experimental Station, Bulletin* 154, pp. 24. Corvallis, Oregon, 1918. — II. Lewis, C. J., Murneck, A. E., and Cate C. C., *Ibid., Bulletin* 162, pp. 39. Figs. 12. July, 1919.

I. — Researches carried out on 8 orchards in soils of various types and cultivated in different ways. In each orchard, the fruits of 6 varieties were gathered at intervals of 4 to 5 days during the whole harvest season, beginning slightly before the period of commercial maturation for all the varieties. The fruits were stored under the following conditions :— Ordinary fruit-loft, dry or ventilated ; ordinary damp fruit-loft ; storage at the temperature usual in railway waggons : cold dry storage ; retarded storage, i. e., the fruit placed in store some time after the harvest ; damp, cold fruit-loft. Samples were taken from each group and determinations made of the specific gravity of the juice and the content in starch, sugar, acids and moisture. The results, relating to the year 1917, are summarised in tables and discussed at length.

The experiments show that, when the fruit can be left on the tree for a longer time than usual, the harvest is greater both in volume and weight. Thinning out the fruit by successive harvests has no influence on the fruit remaining on the tree, but fruit treated in this way and those not treated, increase in size if left on the tree till the end of the period of harvest. This increase in size is less marked in orchards whose soil is lacking in coolness.

A great part of the Rogue Valley fruit is gathered too quickly to allow them to attain their best flavour, although fruit gathered before ripe keep better under ordinary conditions of storage. When Bartlett pears are gathered too early their flavour is harmed less than when varieties kept a long time on the tree, such as Clairgeau, Anjou and Bosc, are gathered early.

With all types of storage, except the ordinary loft, i. e., with storage at the usual temperature of railway waggons, in a cold room, or in a cold, damp room, fruit gathered early does not keep as well as that gathered later.

There is apparently no relation between the size of the fruit and keeping properties as regards pears gathered at the same time from the same tree. Both small and big fruit ripen and decay together.

The authors attempted to ascertain the right moment for harvesting by estimating the starch content but with negative results, the same effect was obtained as regards the specific gravity. It was not possible to establish any direct correlation between the period of gathering, the property of keeping, and the flavour of the fruit on the one hand, and the content in sugar, water, and acids on the other. Small fruit contains a little more sugar and, in the case of the Bartlett, much more acids than large fruit from the same tree.

II. — Report of the chief results obtained during the 1918 season.

The authors examined the increase in volume of Bartlett pears from a statistical point of view. The results, given in tables and diagrams, show that these pears gradually increase in size and volume with a rapidity that increases up to complete ripeness, independently of climate or cultural conditions. The increase in transverse diameter is proportionately more rapid than that in longitudinal diameter. The number of grains that develop (i. e., do not abort) probably has an influence on the shape of the pears. No important change was observed in the average length and diameter of the petiole of the fruit.

Seeing that a storage experiment is of little value as an index of the best time for harvesting, a new " pressure test " was employed to measure the degree of ripeness of the pears at harvest time. The test consists in pressing a steel ball half sunk in a block of hard wood against the central part of the side of the fruit until the wood touches the pear ; the pressure required is recorded. There is apparently a definite relationship between the degree of ripeness of the pears and the resistance to pressure of the tissues of the cortex and epidermal regions. This resistance and, consequently, the degree of ripeness, was measured at intervals of 3 or 4 days. With Bartlett pears, there was a gradual average decrease of resistance amounting to half a pound every 24 hours, using equal surface of pressure during all the ripening period. Experiments carried out 6 hours after gathering are safer than those made about 24 hours after, owing to a change in the degree of ripeness in the fruit after it is gathered. There was no correlation between the transverse diameter of the fruit and its resistance to pressure on the same date. Pressure tests applied to Bosc pears gave similar, if

less obvious, results, for Bosc is a variety that ripens much more slowly and has a thicker epidermis.

Storage investigations with Bartlett pears showed that the size of the fruit is related neither to the degree of ripeness nor to the rapidity of decay. Pears gathered half-way through or at the end of the season kept in a cold store a little longer than those gathered early.

Fruit gathered early is distinctly inferior in quality to that gathered later. A relatively high temperature, combined with a high degree of humidity, prevented Bartlett pears gathered early from ripening to best advantage. Within the limits of a temperature conducive to ripening, no difference was observed in the speed with which stored Bartlett pears ripened when a change of temperature of 10° to 15°F. was registered, provided that the degree of humidity remains approximately constant. Pears gathered very late showed exceptional flavour and keeping qualities, and the authors suggest that this may be due to the late ripening of fruit left on the tree a long time owing to the high temperatures that prevailed during the mid-season.

As regards the storage of Bosc pears in a fruit-loft, it appears that, when they are kept beyond the normal limits of the life of that variety, the humidity should be increased to correspond to the decrease in temperature.

Out of 12 methods of storage tested, the best were :— The ordinary fruit-loft ; storage at the temperature of railway waggons ; storage, 14 days after harvest, at the usual temperature of railway waggons for 12 to 15 days, followed by cold storage. It seems especially important that Bosc pears, if they are to be cold-stored, must be put in at least two weeks after the harvest. The higher the humidity, the shorter can be the interval between gathering and cold storage. A relatively high temperature with low humidity was as harmful to the proper ripening of Bosc pears as was a low temperature with high humidity.

VINE GROWING

657 – **Productivity of Italian Vines.** — *Giornale vinicolo italiano*, Year XLVI, No. 13 pp. 117-127 ; No. 15, pp. 137-138. Casale Monferrato, March 28, April 11, 1920.

The following averages, extracted from the *Bulletin of Agricultura Statistics*, of the Italian Ministry of Agriculture, are for the 9 years, 1907 1917, and relate only to specialised vineyards, as the density of plantatio of vineyards is extremely variable. The numbers express the quantity of grapes in quintals.

Piedmont. — Alessandria 47, Cuneo 42, Novara 33, Turin 26 ; regiona average 40.

Liguria. — Genoa 46, Porto Maurizio 43 ; regional average 44.

Lombardy. — Bergamo 36, Brescia 17, Como 37, Cremona 48, Mantua 3 Milan 88, Pavia 42, Sondrio, 33 ; regional average 33.

Venetia. — Belluno 19, Padua 35, Rovigo 64, Treviso 42, Udine 3 Venice 54, Verona 13, Vicenza 39 ; regional average 27.

Emilia. — Bologna 28, Ferrara 30, Forlì 42, Modena 15, Parma 4 Piacenza 69, Ravenna 23, Reggio Emilia 39 ; regional average 34.

Tuscany. — Arezzo 42, Florence 48, Grosseto 43, Leghorn 37, Lucca 4, Massa and Carrara 38, Pisa 45, Siena 47; regional average 42.

Marches. — Ancona 63, Ascoli Piceno 38, Macerata 51, Pesaro and Urbino 50; regional average 50.

Umbria. — Perugia 34.

Latium. — Rome 42.

Abruzzi and Molise. — Aquila 22, Campobasso 26, Chieti 28, Teramo 37; regional average 28.

Campania. — Avellino 45, Benevento 46, Caserta 47, Naples 61, Salerno 27; regional average 43.

Apulia. — Bari 19, Foggia 25, Lecce 25; regional average 23.

Basilicata. — Potenza 21.

Calabria. — Catanzaro 22, Cosenza 20, Reggio Calabria 44; regional average 28.

Sicily. — Caltanisetta 34, Catania 53, Girgenti 35, Messina 40, Palermo 44, Syracuse 31, Trapani 27; regional average 39.

Sardinia. — Cagliari 18, Sassari 28; regional average 19.

General average for the kingdom: — 32.

Of the 16 Italian regions the productivity of 10 is above the average; these include all those of central Italy most of those of northern Italy, and southern regions such as Campania and Sicily. Amongst the regions whose productivity is below the average for the Kingdom are all the remaining southern regions in Sardinia and Venetia.

There are also considerable differences in the productivity of the vineyards in the different provinces even if in the same region. The productivity varies:—

from	26	to	27	quintals	per	hectare	in	the	provinces	of	Piedmont.
»	43	»	46	»	»	»	»	»	»	»	Liguria.
»	17	»	88	»	»	»	»	»	»	»	Lombardy.
»	13	»	64	»	»	»	»	»	»	»	Venetia.
»	15	»	69	»	»	»	»	»	»	»	Emilia.
»	37	»	48	»	»	»	»	»	»	»	Tuscany.
»	38	»	63	»	»	»	»	»	»	»	the Marches.
»	22	»	37	»	»	»	»	»	»	»	Abruzzi and Molise.
»	27	»	61	»	»	»	»	»	»	»	Campania
»	19	»	26	»	»	»	»	»	»	»	Apulia.
»	20	»	44	»	»	»	»	»	»	»	Calabria.
»	27	»	44	»	»	»	»	»	»	»	Sicily.
»	18	»	28	»	»	»	»	»	»	»	Sardinia.

By classing productions not above 20 quintals of grapes per hectare as poor, those from 21 to 30 quintals as medium, those from 31 to 50 quintals as good, and those above 50 as abundant, the 69 provinces of Italy can be arranged in increasing order of productivity in the following way:—

Provinces with a poor production. — Verona, Modena, Brescia, Cagliari, Belluno, Bari, Cosenza.

Provinces with a medium production. — Potenza, Aquila, Catanzaro,

Ravenna, Foggia, Turin, Campobasso, Lecce, Salerno, Trapani, Bologna, Sassari, Chieti, Ferrara, Udine.

Provinces with a good production. — Syracuse, Sondrio, Novara, Caltanisetta, Perugia, Girgenti, Padua, Bergamo, Como, Leghorn, Teramo, Massa and Carrara, Mantua, Ascoli Piceno, Vicenza, Reggio Emilia, Messina, Lucca, Arezzo, Forlì, Treviso, Cuneo, Grosseto, Parma, Porto Maurizio, Rome, Reggio Calabria, Palermo, Avellino, Pisa, Genoa, Benevento, Siena, Caserta, Alessandria, Cremona, Florence, Pesaro, and Urbino.

Provinces with an abundant production. — Macerata, Catania, Venice, Naples, Ancona, Rovigo, Piacenza, Milan.

The major part of the provinces of Italy, consequently, produces from 31 to 50 quintals of grapes per hectare in specialised vineyards. One third of the provinces, however, has either poor or medium productivity and, in a few others (8), the production is abundant.

Amongst the first ones are those belonging to 13 different regions in which, however, only Tuscany and Liguria, as well as Latium and Umbria, figure with all their provinces. In 3 regions, i. e., in Basilicata, Apulia, and Sardinia, the vines in all the provinces produce less than 20 quintals of grapes per hectare. Some of the provinces of 6 regions are abundant producers, with over 50 quintals of grapes per hectare.

The average productivity of the specialised vineyards, therefore, varies, in the different provinces, between very wide limits and very large differences exist between provinces in the same or adjacent regions.

The author believes that some of these figures are below the actual amount. Thus, the Apulian vineyards produce an average of 35 to 45 quintals of grapes per hectare and, in Sardinia, the vineyards at Campidano easily produce 50 to 60 quintals per hectare, whilst the production in the northern part of the island is at least 30 quintals per hectare.

658 – **Vines with Small and Large Grapes.** — Sannino, E., A., in the *Rivista di Ampelografia* (1), Year 1, No. 1, pp. 7-8. Alba-Livorno, January, 1920.

Varieties of vines such as Barbera, Freisa, and Sirah have two forms equal as regards the external characters of the leaves and bunches, but different in so much as one has small grapes and the other large ones. The composition of the must is a further difference that also corresponds, as that of the sub-variety with small grapes is sweeter. The Barbera with large grapes is mainly grown at Montefalco, in Umbria, and at Casale, whilst that with small grapes is cultivated in the Tanaro valley. The Tanaro wines are much more alcoholic than those of Casale. There is also another variety whose forms differ solely in the size of the grapes ; this is the Ver-

(1) The object of this new Review, edited by Prof. T. A. Sannino, Director of the "Regia Scuola di Viticoltura ed Enologia" of Alba, is to make ampelography the basis of viticulture, in other words, the study of each variety of vine, so as to make it possible to choose the most productive types for each locality and to make better wines. In addition, the Review will deal with specialised or associated viticulture, œnology, the production of wine, trade, etc. (*Ed.*)

diso of the province of Treviso which has 2 sub-varieties, the " Verdiso gentile " and the " Verdiso grosso " or " Verdisone ". These are grown together and to obtain an abundant production of wine, the Verdisone is given prominence, though it is well known that a better wine is obtained when " Verdiso gentile " predominates. The grapes of " Verdiso gentile " usually contain but one pip, few containing two ; with Verdisone, however, grapes with 2 and 3 pips predominate. The well-known influence of the number of pips has the result that must from " Verdiso gentile " grapes is richer in sugar than must from Verdisone grapes. The origin sub-varieties of this kind must be attributed to a bud mutation. The vines known as Aglianico, Aglianicone, and Aglianichiello, of the province of Avellino, constitute 3 different varieties.

The case of the Sangiovese of Tuscany (that with an oval, fairly large grape) is different ; in certain years, it bears bunches with numerous small grapes, pipless though ripe, and a small number of large grapes that are not so sweet. The formation of very small grapes in the Sangiovese vine depends on the year, and it seems that, if it rains at flowering time, bunches are formed that have pipless grapes.

659 – **Yellow and Green Grapes.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Year 1, No. 5, p. 74. Alba-Livorno, March 1, 1920.

Some white vines produce fine golden-yellow grapes, while others produce a grape that is more or less greenish even when completely ripe. The general opinion is that the greenish colour indicates a small sugar content, whilst the yellow colour indicates the reserve. But this is not always so and the author mentions several exceptions. Amongst grapes of an intense yellow colour, even with orange tones, are those of the following vines: — Erbaluce from Caluso (Ivree, province of Turin), Garganeza from the hillsides of Verona and Vicenza, Ribolla from Friuli, Lussuriet from Piedmont, and Malvoisy from Lipari. Ribolla and Lussuriet, however, are poor in sugar and Ribolla even lacks acidity. The Lussuriet vine grown by the author yielded grapes with but 14 % of glucose and wine of excessive acidity that could still be detected even after blending with other wines. Amongst vines with grapes that are more or less green, even when completely ripe, are Verduzzo, Verdiso, Verdea, Verdicchio, Verdone (all different vines), almost all of which have grapes rich in sugar, especially the Verduzzo from Friuli, which has small grapes and yields must rich in sugar, 20 % and more. Another peculiarity of the Verduzzo grape is its very tannic pulp, a condition which does not occur in the other grapes, even if their skin is very rich in tannin.

660 – **The Catarratto Moscato Cerletti Vine.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Year 1, No. 3, pp. 33-36. Alba-Livorno, February 1, 1920.

The author describes the cross obtained by Baron A. MENDOLA in 1869 by fertilising white " Catarratto " with pollen from " Moscatellone " (also called " Zibibbo " or " Salamanna "), and observes that this vine deserves to be better known and more largely grown, especially in Apulia, where the reconstitution of the vineyards is being undertaken so enthusiast-

ically. The vine is of value for the abundance and good quality of its grapes, which combine the qualities of the parents and can thus be used either for the table or for the manufacture of liqueur wines. Almost all the modern muscatels have bare leaves, but Catarratto " has cottony leaves, such as PLINY describes for the " apiane " grapes, which, according to M. MENDOLA, correspond to the modern muscats.

661 – **The " Dolcetto " Vine and its Variety with Red Leaves.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Year I, No. 6, pp. 81-82. Alba-Livorno, March, 15, 1920.

The author states that the " Dolcetto " vine, grown on the hillsides of the Alba district (province of Cuneo) has a form whose leaves turn red in autumn much earlier than the leaves of the ordinary form. This is correlated with the reddish coloration of the peduncles of the grapes, with a lower content of glucose in the grape, and with a shorter period of ripening.

662 – **Phylloxera in Italy and the Best Grafting Stock.** — SIGNORINI, M., in the *Giornale vinicolo italiano*, Year XLVI, No. 5, pp. 37-39. Casale Monferrato, February 1, 1920.

A good grafting stock should satisfy the following conditions: — It must be sufficiently resistant to the phylloxera, it must be adapted to the climate and soil of the region where it is planted, particularly to the lime content of the soil, and it must have a good affinity with the scion. Starting from these considerations, the author advises the use in Italy of the following grafting stock as worthy of being widely grown and of full consideration by the vine-grower, particularly as regards their general affinity for all the Italian vines:—

FOR NORTHERN ITALY: — *Riparia Rupestris* 3306, in fresh compact soils or in rather dry, but well-manured soils with not more than 25 % of lime, and for all Italian vines.

Riparia Rupestris 101-14, in good, deep, fresh, somewhat light soils, with not more than 25 % of lime, and for all Italian wines.

Aramon Rupestris Ganzin 1, in all save very arid soils, even if very compact, clay or calcareous, but with not more than 50 % Ca CO_3, provided that the sub-soil is sufficiently cool, for all Italian vines, especially if whip grafted.

Mourvède Rupestris 1202, as the preceding one, but with greater tolerance for lime (60 %) and a greater facility for taking grafts.

FOR SOUTHERN ITALY:— *Rupestris metallica*, in arid, compact soils, in gravelly soils, in tuffs with not more than 15 % of lime, for all the Italian vines, especially those with white grapes.

Rupestris du Lot, even in arid, compact soils, and in stony, poor soils, with not more than 35 % of lime, for all the Italian vines.

Berlandieri Riparia 420 A, even in arid, gravelly, and calcareous (50 %) soils, for all the Italian vines.

Berlandieri Riparia 751-11, like the preceding one, but with less resistance to drought.

FOR CENTRAL ITALY:— All the above mentioned vines can be successfully grown there. Other good vines are worth special attention fo vine-growers (e. g., *Riparia gloire de Montpellier*), and others have not a

good affinity for all the Italian vines (*Riparia gloire de Montpellier*, Riparia × Rupestris 3309, etc.) ; others are particularly suited for special soil conditions, such as *Chasselas Berlandieri* 41 B for very calcareous soils (70 %), very arid, poor soils, for all the Italian vines ; *Solonis Riparia* 1616 for all very damp soils, and saline soils, with more than 30 % of lime.

The distinction made between vines suited to northern Italy and those suited to southern Italy is not absolute, because there are vines such as *Berlandieri Riparia* 420 A which, although more adapted to southern Italy, are successfully grown in northern Italy and *vice versa*.

763 – **Two Good Grafting Stocks from the Trentino.** — ZANOTTI, L., in the *Rivista di Ampelografia*, Year 1, No. 3, p. 38. Alba-Livorno, Feb. 1, 1920.

The Agricultural Institute of St. Michele and the Provincial Agricultural Council of Trentino, have imported into the Trentino Americo-American hybrids, selected in Hungary and Germany, and which were known as good grafting stock. They also distinguish themselves in the Trentino for their robust growth, their adaptability to most of the soils of the region, and by their efficacious resistance to phylloxera. On account of their value from these points of view, the author advises that they should be tested in other regions of Italy, especially where other grafting stocks have not given very satisfactory results. Amongst these vines, mention should first of all be made of two hybrids selected by TELEKY in Hungary, starting from grapes of French origin, i. e., Riparia × Berlandieri Teleky No. 5 and No. 8, and Rupestris × Berlandieri Teleky 10A.

Riparia × *Berlandieri Teleky Nos.* 5 *and* 8. — Very vigorous vine, with large, trilobate leaves of a dark brilliant green that makes it resemble a Riparia rather than a Berlandieri. The buds are light, bronzed, whilst the shoots are greyish long, and uniform in colour. The root system is well developed and tends to penetrate deeply in the soil. It has a good resistance to phylloxera, it adapts itself to soils rich in lime, even stony soils ; it specially suits cold regions and does not suffer much from drought. It stands grafting well and gives vigour to the scion, whose production seems improved. The wood matures well, but the cuttings do not root very strongly.

Rupestris × *Berlandieri Teleky* 10A. — Vine of robust growth, with much ramified roots that tend to go deeply in the soil. The large, rounded leaves are like those of Rupestris. The shoots are vigorous and ripen their wood well, much being produced, provided that the vines are far enough apart to permit of lateral growth. The resistance to phylloxera is excellent, as is that to lime, whilst drought is resisted well ; the vine is thus suitable for stony, dry and calcareous hill soils. It supports grafting well, and gives off roots more easily than the preceding stock. The grapes produced by the scions ripen normally and are of good quality.

To sum up, both stocks show the good characters of their parents, whilst being free from their defects. The Riparia × Berlandieri Teleky, however, has the disadvantage of taking rarely from cuttings, a disadvantage generally found in all the descendants of Berlandieri.

664 – **The Behaviour of Frozen Vines in North Italy.** — GABOTTO, L., in *Il Coltivatore*, Year 56, No. 5, pp. 20-120, fig. 1. Casale Monferrato, Feb. 20, 1920.

The frosts that were rife in upper Italy at the end of April, 1919, enabled the author to make observations on frosted vines, and on the effects of the pruning usually recommended for such vines. He concluded from his observations that, when frost has destroyed most of the opened buds, it is radically necessary to prune the vine, especially if it is full grown; in fact, it is impossible, even under the most favourable conditions, for the vine to repare the harm by producing supplementary shoots on that years' branch. Even if such shoots appear, they can not develop to any useful extent. Radical pruning, however, concentrates all the vitality of the plant on a few latent buds which, once the inevitable arrest of growth due to pruning has passed, are abundantly nourished and can produce shoots which, if they bear no fruit, will reconstitute the branch for the next year.

Topping the frozen buds was found to be useless as it did not vivify the under buds to any noticeable degree, i e., in such a way as to develop normally and produce fruit.

But a doubt remains regarding the productivity of the shoots developed after pruning the branch radically for, as they are not borne by second season wood they ought, so it is generally thought, to be sterile.

665 – **Mechanical Cultivation of Vineyards: Ploughing with Two Motor Windlasses of the "Établissements Albert Douilhet" and a Chapron Tractor.** — See No. 686 of this *Review*.

FORESTRY

666 – **The Forest Resources and Woods of the French Colonies of the Ivory Coast and Gabon.** — DABAT, L., Director General of the Woods and Forests Service. Report presented in the name of the Agricultural Committee on the Colonial Forestry Mission of Commander BERTIN, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXIX, Vol. 132, No. 1, pp. 17-21. Paris, Jan.-Feb., 1920.

The pre-war production of timber in France was well below the needs of the country and the annual excess of the imports over exports averaged 880 000 metric tons, corresponding to 2 000 000 cu. metres of standing timber. This deficit will have been greatly increased by the war and the French requirements will have been considerably augmented because, in addition to the normal consumption, provision has to be made for replenishing exhausted stocks, for reconstituting the liberated regions, for remaking the railroads and because, to satisfy the needs increased in this way, there will only be a production that has been reduced by the extensive exploitation and the destruction of forests due to the war. Considerable quantities of timber will, therefore, have to be imported. Instead of buying the timber in foreign countries that will require payment in gold, France has every interest to obtain supplies from her colonies, as these possess immense forests. Besides, the exploitation of the colonial forests would be equally advantageous both to the home country and the colonies. The difficulty is that colonial timber, except for valuable woods for cabinetwork, is hardly, if at all, known and is neglected by the trade.

During the war, the French Government dealt with the utilisation of colonial timber, and a mission headed by Commander BERTIN, Inspector

of Woods and Forests, was sent by the Ministries of War, Armaments, and the Colonies to study on the spot the forest resources of the French colonies. The first work of the mission, carried out in 1916 and 1917, bore on the timbers of the colonies of the Ivory Coast and Gabon, and M. BERTIN published the results in a work entitled *Mission forestière coloniale* (1). This work is in 3 volumes, the first two of which were published in 1918, while the third has just appeared.

The third volume, "La Question Forestière Coloniale", should, as the author himself remarks, logically have preceded the other but, during the war, it was much more important to prepare for the future by publishing the results obtained than to go back to the past and show the reasons which led to the organisation of the mission. The third volume, therefore, will be considered first: it is divided into 6 books.

In *Book* I, written at the beginning of 1918, there is a copious documentation, extracted from the best sources, on the pre-war production and consumption of timber in France, on the estimated requirements and resources at the end of hostilities — such as could be foreseen at the time of writing — on the value of colonial timber compared with that of other common timber, on its cost and pre-war trade.

M. BERTIN comes to the conclusion that the exploitation of her colonial forests is the only way in which France can meet her increasing needs without diminishing her financial reserves and that, consequently, the State must place these timbers on the French market, ensure immediate exploitation, and build up stocks in the colonies to be made use of as circumstances permit.

Book II consists of a study on the tropical forests in the Ivory Coast, Gabon, Cameroons, and in general of equatorial Africa, where the varied flora comprises from 1000 to 1200 species, amongst which 200 or 300 are very common. Valuable information is also given regarding the prospecting carried out by the mission.

Book III is a summary of the technology of colonial forestry and deals with exploitation, cutting up, conservation, transport and loading of the timber; appendices contain interesting notes on saw-mills in Canada, the United States, Sweden, etc.

Book IV deals with the beneficial influence of forests on the climatic conditions and fertility of tropical regions, with sylviculture and the management of colonial forests, and with forest regulations in the colonies. M. BERTIN concludes that the organisation of a colonial forestry service is necessary.

In *Book V* the technical properties and industrial classification of colonial timbers are discussed, and the tests carried out on the timbers brought back by the mission are described. The physical and mechanical tests were carried out in the testing laboratory of the "Conservatoire des Arts et Métiers" the industrial tests at Aubervilliers, Charenton and Vil-

(1) This report was dealt with in the first part of a general article on the same subject which appeared in *R.*, June, 1919, No. 742. (*Ed.*)

lers-Cotterets, and the tests for conservation and life, still in progress, at the Jardin Colonial at Nogent.

Book VI reproduces the report by M. BERTIN on the colonial forest question and on the steps required for the immediate intensification of the production of colonial timber.

Of the first two volumes, one deals with the Ivory Coast and the other with the Gabon, and both are so presented as to facilitate comparison.

The mission attempted to ascertain which were the commonest trees in tropical forests and which of these could substitute European timber for ordinary uses ; 300 species were studied out of some 800 and submitted to practical tests for resistance to bending, resistance to elongation and splitting, and the resistance of assembled pieces. Only some 40 trees were retained in each of the two colonies, and it apparently was not possible to reduce this number. A profitable industrial enterprise requiring the installation of costly means of transport, is obliged to exploit numerous trees contained in a restricted area, a condition that cannot be realised in tropical stands, mixtures of varied trees, unless a fairly large number of different species utilised. The species in question constitute about two thirds of the population.

M. BERTIN's report has the aim of making known these trees and the technical properties as much to traders and to industrialists that utilise timber as to foresters and those who exploit tropical forests. A vocabulary of the usual woods of the colony is given for the timbers retained after examination ; the names have been borrowed from the native languages, the most common and easily pronounceable having been chosen from the various names, whilst attempting to retain the names already given by exploiters or known in the European trade. The vocabulary gives for each tree its scientific name, the vulgar name suggested, and the name in the various dialects. The terminology thus proposed has been submitted to the Governors of the interested colonies and approved by the Ministry for the Colonies.

In the second chapter lists are given of the timbers that could replace the common European woods for most ordinary uses and of the timbers suitable for special purposes. The first list comprises 27 trees from Gabon and 17 from the Ivory Coast, and the second 22 from Gabon, and 17 from the Ivory Coast. The lists give the ordinary, scientific and local names, possible uses, similarities with the fine timbers used in Europe, and the minimum girth at which the tree can be exploited. The last mentioned detail is to ensure the conservation of the forests and to prevent the felling of trees that are too young.

The timbers are grouped according to quality in 3 classes :—

(1) Inferior whitewoods, that can replace inferior poplar, chestnut, etc.

(2) Superior whitewoods, than can replace choice poplar, pine, etc.

(3) Hardwoods that can replace oak.

When there is occasion to do so, the accessory products such as fruits, seeds, latex, bark, etc., that each tree may produce are indicated.

The physical properties of the timbers are described in a third chapter,

which gives general information as to appearance, grain, density, hardness, working qualities, and the behaviour of cut timber.

Each volume concludes with a list of local names to enable the trees to be identified and with an alphabetic list of the scientific names with references to the usual names.

The work is illustrated with photographs of various aspects of the tropical forest, of exploitation, and of transportation.

The practical results of the mission will doubtless considerably influence the question of colonial timber, on the solution of which the economic future of France depends to a large extent. In the book in question, besides the results of examining the colonial timbers, which are thus placed before the public, there is a mass of statistical, economic and commercial information on the production of timber in France and the colonies, and information on the technical properties of woods, the collection of which in a single volume will be of value to all those interested in the exploitation of forests and the utilisation of timber and in trade.

LIVE STOCK AND BREEDING

667 – **Identification of the Trypanosomes of the Italian Colony of Eritrea.** — Pricolo, A and Ferraro G., in *La Clinica veterinaria, Rassegna di Polizia veterinaria ed Igiene*, Year. XLIII, No. 4, pp. 111-123. Milan, Feb. 29, 1920. HYGIENE

A critical summary of previous investigations on the trypanosomes of African animals and a description of researches carried out by the authors in Erythrea. The following conclusions were arrived at:—

The presence of two trypanosomes in the Italian colony of Eritrea is demonstrated; these are *T. Evansi* of the camel and horse and *T. vivax uniforme* of cattle.

It has not been demonstrated that *T. Evansi* is found in cattle in a natural state, nor that *T. vivax uniforme* occurs in camels and horses. The camel was refractary to *T. vivax-uniforme* under experimental conditions.

668 – **The Fowl Tick and its Riddance from Hen-Houses** (1). — Bishopp, F. C., in the *U. S. Department of Agriculture, Bureau of Entomology, Circular No.* 170, pp. 14, figs. 9. Washington, December, 1919.

The fowl tick (*Argas miniatus*, syn. *A. persicus*) is extremely widely distributed; it is an important pest of poultry in Rumania, Southern Russia, Persia, India, North Africa, South Africa, Australia, Brazil, British Guiana, Panama, West Indies, Mexico and the United States (2). It is a serious pest in the last-named country and causes losses estimated at millions of dollars annually. It is specially abundant in the warm areas

(1) For further information on the fowl tick and the diseases it may propagate, see *R.* 1913, Nos. 42 and 823; *R.*, 1916, No. 318; regarding ecto-parasites of poultry in genera see *R.*, 1915, No. 1313; *R.*, 1917, No. 830; *R.*, 1918, No. 779; *R.*, 1919, No. 496; *R.*, 1920 Nos. 338 and 339.

(2) In Europe, the most important tick of poultry is *Argas reflexus*, but it appears to be rare in England and Germany, whilst it is common in France and Italy. — Pesce, A., Diseases of Fowls, p. 248, Milan, Hoepli, 1912. (*Ed.*)

of the arid and semi-arid region, *viz.*, Western Texas, the south of New Mexico and Arizona, and Western California. It has also been reported in Florida and Iowa, but it will probably never become of continuous importance as a parasite in the states to the east of Texas, owing to the damp climate.

Although fowls are the host most frequently attacked. *A. miniatus* also attacks ducks, geese, turkeys, ostriches, pigeons canaries, and wild birds. It has been recorded as an occasional parasite of cattle and horses, and, in experimental cages, it has attacked rabbits and other small rodents, though it does not appear to attack rats and mice under natural conditions. It is said that, in certain countries, especially Persia, the tick attacks man, causing serious disturbances, but there is no authentic record of such a case in the United States. It may cause the death of fowls directly through exhaustion and by continual irritation or indirectly by transmitting spirochetosis. It may cause other losses by decreasing the vitality of the fowls, by rendering them more liable to contract disease, by seriously diminishing the capacity for laying eggs, by disturbing sitting hens and by causing pullets to grow more slowly.

The eggs of *Argas miniatus* hatch in from 10 to 100 days. The larvae, furnished with 3 paired appendages, attach themselves to a chicken and feed on its blood for from 3 ½ to 10 days, then they fall to the ground, particularly at night time and hide in some crevice. In 4 to 7 days, the larva becomes a nymph, with 4 pairs of appendages and again attaches itself to a host, gorges itself with blood in a few hours, drops off and hides. The nymph moults after each of the 3 meals of blood, and the sexual organs appear after the last moult. After a fresh meal of blood, the female is ready to lay, and can lay 8 separate times, each laying being followed by a fresh meal of blood. Each female lays from 500 to 900 eggs. The tick can complete its life cycle in about 40 days, but the number of generations in a year has not been determined ; there are, however, probably six in the southern part of its zone of distribution.

The tick has remarkably few enemies ; the small black ant (*Monomorium minutum*) and certain spiders that live in houses destroy its eggs and larvae, whilst rats and mice also destroy them. Fowls eat ticks greedily, but the ticks are largely protected by their habit of hiding during the day and coming out for food at night.

Regarding preventive measures, any fowls from another hen-house must be rigorously quarantined before allowing them to mix with poultry free from the parasite. If the hen-house is not of much value, it should be burnt ; in other cases, any unnecessary boxes, planks, etc., that might shelter ticks should be removed and the hen-house sprinkled with pure kerosene, crude petroleum, carbolineum, milk of lime containing carbolic acid, a strong kerosene emulsion, boiling water, or with a fluid used to destroy ticks on cattle (1).

(1) See *R.*, 1911, Nos. 2198, 2425, 1753 ; *R.*, 1912, Nos. 146, 359, 810, 934 ; *R.*, 1913, Nos. 42, 43, 691, 815, 1264 ; *R.*, 1914, No. 1019 ; *R.* 1915, No. 1170 ; *R.*, 1918, Nos. 541 and 1376. (*Ed.*)

Boiling tar should be used to fill up the cracks and kill any ticks hidden them. The fowl tick, however, is a parasite which is most difficult o destroy, insecticidal powders and fumigations with hydrocyanic acid eing quite useless.

The fowls can be cleared of the ticks on their bodies by dipping them gasoline, but this treatment is too hard on the fowls to be recommended. simple and cheap method of prevention consists in hanging the roosts om the roof with wires, in such a way that the fowls do not come in con- ct with the sides of the hen-house ; the roosts should be quite smooth nd free from bark and cracks.

Applications of insecticides also destroy chicken mites (*Dermanyssus allinae*) and chicken fleas (*Echidnophaga gallinacea*). The fowl tick can e kept away from the hen-house by means of scrupulous cleanliness and onstant attention. In Texas, the pest has been avoided by using all- etal hen-houses, made of corrugated iron. Such hen-houses, however, annot be used in hot climates as they are not cool enough. Nesting- oxes that are easily cleaned are very useful ; those consisting of wire auze on which the straw is placed can easily be freed of parasites by assing the wire basket through a flame. Metal boxes, through which cks cannot pass, placed on legs standing in saucers filled with kerosene ould also be used.

69 – **The Tropical Fowl Mite (*Liponyssus bursa*) in the U. S. A.; Biology and Control.** Wood, H. P., in the *United States Department of Agriculture, Department Circular* 79, pp. 8, figs. 2. Washington, Jan., 1920.

Up to the present, two cases of infection by the tropical fowl mite (*Liponyssus bursa*) have been recorded, one from Madison, one from Illi- ois (at Raymond). The risks that this fowl ectoparasite may become stablished in the United States has made it necessary to study its biology nd means of control, the work being carried out by the author at Raymond ll. Mr. H. Hirst, of the British Museum (Natural History), has recorded *L. bursa* for Africa, China, India, Mauritius, the Comoros Islands, the Bahama Islands, South America, countries where the ordinary fowl mite (*Dermanyssus gallinae*)) does not occur. Apparently, *L. bursa* transmits pirochetosis and, besides fowls, it attacks wild birds (particularly spar- ows) and, so it is said, man. On the contrary to *Dermanyssus gallinae*, t attacks its host both day and night.

The author found, in the course of his work, that *L. bursa* lays its ggs either on its host or in the nest. Many of the eggs are stuck to the basal, softer portion of the feather by a sticky material. The eggs, ob- served away from the host, hatch in 3 days. The tiny larva does not feed t first, but it moults in about 17 hours, after which it is ready to suck blood. The nymph resulting from the first moult again moults in 102 hours, fter which its history is uncertain.

The most effective remedies are :— (1) A bath containing sulphur 150 gm., soap 75 gm., and water 10 litres ; (2) dusting sulphur and pyre- thrum under the feathers ; (3) bath composed of a teaspoonful of 40 %

nicotine sulphate in 4 litres of water containing about 10 gm. of soap. At Raymond, these treatments were followed by thorough cleansing and disinfection of the hen-houses, etc., and finally the fowls were carefully dusted with sulphur and exposed to the rain. No ill effects were noticed after the treatment and the author considers that this curative method, combined with a continual war against sparrows, which harbour the same parasite, would completely suppress the present infestation.

ANATOMY AND PHYSIOLOGY

670 – **Variations and Mode of Secretion of Milk Solids.** — Cowen, J. W., in the *Journal of Agricultural Research*, Vol. XVI, No. 3, pp. 79-102, bibliography of 40 works, Washington, D. C. Jan 20, 1919.

Work carried out in the Biological Laboratory of the Maine Agricultural Experiment Station, utilising data from the registers of the Holstein-Friesian Association and relating to pure-bred Holstein-Friesian cows.

The author gives the means deviations and the variation coefficients of the annual registrations. The mean annual production of cows at a mean age of 4 years was 15417 lb., of milk, 528 lb. of butter fat and 1303 lb. of solids not fat. The standard deviations were 3742 lb. of milk, 134 lb. of butter fat and 260 lb. of solids not fat (at 2 years) and the coefficients of variation were, respectively, 24, 25, 20, and 50 %. In a table, reproduced herewith, Holstein-Friesian milk is compared with that of other breeds, and in another table comparison is made with that of other species. The author then considers the correlations that exist between the following variables :— Per cent. of butter fat and quantity of milk produced; per cent. of butter fat and age ; per cent. of solids not fat and quantity of milk produced ; per cent. of solids not fat, and age. From these correlations the following conclusions were drawn :—

(1) With the increase of the quantity of milk produced, the percentage of fat in that milk decreases. The value of this decrease, measured statistically, is very significant, but, in practice, the decrease in fat content would be discerned with difficulty in small samples.

(2) The correlation between the age and the butter fat content is not significant.

(3) The correlation between the quantity of milk produced and the percentage of solids not fat is not significant ; in other words, the quantity of milk produced in one year is independant of the concentration of the solids not fat. From the genetic point of view, this fact signifies that the hereditary factors for high or low milk yield are separate and distinct from those which determine a high percentage of solids not fat.

(4) The correlation between the age and the solids not fat is -0.2191 ± 0.0351, that is, with increasing age of the cow, the percentage of solids not fat decreases.

(5) All the regressions are linear, i. e., they take place uniformly.

(6) There are thus two variables that have a divergent influence on the concentration of butter fat and solids not fat. This difference in action proves that the fat and solids not fat cannot be derived from a single chemical compound.

The author also gives the correlations that exist between the variables :— Weight of milk, butter fat, solids not fat

Average of the constituents of the milk of various breeds of cattle.

Breeds	Total solids. Per cent.	Fat. Per cent.	Solids not fat. Per cent.	Ratio of solids not fat to butter fat.
Mollitaler	13.22	3.86	9.39	2.43 : 1
Blondvich	12.75	3.67	9.09	2.48 : 1
Angler	12.51	3.51	9.00	2.56 : 1
Leverland	11.86	3.09	8.77	2.83 : 1
Dutch	11.54	3.05	8.04	2.63 : 1
East Frisian	11.80	3.09	8.71	2.81 : 1
Lova Rhive	12.12	3.31	8.81	2.66 : 1
Breitenburg	12.34	3.36	8.98	2.67 : 1
Red Holstein	12.07	3.27	8.80	2.69 : 1
Wesermarch	11.85	3.24	8.61	2.65 : 1
Schwyz	12.76	3.60	9.16	2.52 : 1
Simmenthal	13.27	4.05	9.22	2.28 : 1
Westerwood	12.99	3.79	9.20	2.42 : 1
Glan	13.57	4.16	9.41	2.26 : 1
Alderney	13.60	3.81	9.79	2.57 : 1
Jersey	14.39	5.12	9.27	1.81 : 1
Guernsey	13.61	4.53.*	9.08	2.00 : 1
Holstein-Friesian	12.02	3.44	8.60	2.50 : 1
Ayrshire	12.46	3.62	8.84	2.44 : 1
Shorthorn	12.61	3.70	8.91	2.41 : 1
Polled Jersey	13.93	4.67	9.26	1.98 : 1
French Canadian	13.32	4.00	9.32	2.33 : 1
Dutch Belted	12.31	3.40	8.91	2.62 : 1
Brown Swiss	12.61	3.62	8.99	2.48 : 1
Red Polled	12.66	3.67	8.99	2.45 : 1
South Devon	12.93	3.72	9.21	2.47 : 1
Kerries	13.10	4.02	9.08	2.26 : 1
Dexter	12.58	3.46	9.11	2.63 : 1

* This percentage is less than the real one as the average content of the milk of 4 900 Guernsey cows was 4.9% of fat.

All the variables are in a close correlation, which ranges from $r = 0.8644 \pm 0.0093$ to $r = 0.9497 \pm 0.0036$. The regressions are linear in every case. The partial correlation between the butter fat and the solids not fat for a constant value of the milk is 0.5635 ± 0.0252. This correlation, with those quoted above, provides the necessary data for establishing the conclusion that certain of the factors on which high fat content depends are also responsible for the high concentration for some of the solids not fat in cow's milk. From this correlation can be deduced the important practical conclusion that if, in a given herd, the concentration of fat or of solids not fat is improved, the increase of one of these constituents will also lead to a concomitant increase of the other.

In conclusion, the author gives a series of data showing the diurnal variation in the composition of cow's milk, from which it is seen that the morning milk contains an average of 0.678 to 0.723 % less butter fat than evening milk, there being no appreciable difference between the morning and evening milk as regards solids not fat. These data furnish criteria for choosing between the theories advanced to explain the secretion of the milk solids. According to the theories which postulate that the milk solids are derived from cellular disintegration, the cell must contain a fixed amount of solids not fat. The butter fat, however, varies in such a way that, in long intervals between milking, the cell accumulates less fat than in shorter intervals ; that is, the cell contains relatively more protein and sugar than fat if the interval between milking is prolonged. This does not agree with what is known as to the formation of the fat, because it is generally admitted that the cells, composed mainly of protoplasm, are formed first, and that, with time, the cell becomes more and more charged with fat at the expense of the protoplasm. Unless these mammary cells behave in an entirely different way from the other cells of the organism, the variation in the fat content with the variation of the interval between milking should suffice to discredit the hypothesis of cell disintegration and make it quite unacceptable. On the contrary, in as far as regards the variations of the secretory glands, the variations in the milk correspond quite well with the hypothesis that its solids are the products of secretion.

FEEDS AND FEEDING

671 – **Tea Leaves as a Feeding Stuff.** — ARUCH, E., in *L'Italia agricola*, Year 57, No. 1, pp. 17-19. Piacenza, January, 15, 1920.

The composition of tea varies according to its quality, origin, manner of drying and fermentation, etc., but it is always rich in nitrogenous matter, varying from 18 to 38 %, tannin (10 to 18 %), and water-soluble matter, which varies from 34 to 44 % for black teas and 39 to 43 % for green teas. The following percentages are given by KÖNIG (*Lehrbuch der Nahrungsmittelchemie*, Leipzig, 1913), as an average of 70 analyses, and by VILLAVECCHIA (*Dizionario di Merceologia*) :—

KÖNIG	Per cent.	VILLAVECCHIA	Per cent.
Moisture	3.9 to 16.2	Moisture	9.50
Nitrogen	2.5 to 6.	Nitrogenous matter	24.50
Caffein	0.9 to 4.5	Caffein	3.58
Essential oil	0.5 to 1	Essential, oil, fats, resins, chlorophyll	6.30
Fat, chlorophyll, wax	0.5 to 10	Gum, dextrin	6.44
Crude fibre	9.9 to 15.7	Tannin	15.05
Ash	3.8 to 8.4	Peptic matter	16.02
Water-soluble matter	2.4 to 40	Ligneous matter	11.58
		Mineral matter	5.65

Tea leaves have lost practically all their tannin and caffein, but retain most of their protein.

Samples of black tea examined by the author and Dr. PULZONI were found to contain 2.10 % of caffein before infusion and 0.129 % after infusion. A sample of black tea, examined by Dr. L. BELLUCCI, contained, on a dry-matter basis, 37.95 % of nitrogenous matter before infusion, after which it had lost 12.95 %. In addition, tea leaves retain part of their fat and dextrin, and have thus a certain food value.

The author, using rabbits, found that dried and powdered tea leaves could replace quite well a third, or one half, or even the whole of the ration of meal and bran, and give satisfactory increases of weight. The rabbits liked the new food, which would probably be eaten by other domestic animals.

Tea leaves might constitute an important by-product for certain countries, as is indicated by the following figures from the *Atlas of the World's Commerce*, showing the annual consumption of tea, in metric tons, in various countries : — England, 115 600 ; United States, 36 900 ; Russia, 57 900 ; Holland, 3600 ; Germany, 3100. In Italy, however, the annual consumption only amounts to 200 metric tons.

672 - **Castor Cake as a Cattle Food.** — TRIVELLONI, in the *Rivista di Ampelografia*, Year 1, No. 4, p. 59. Alba-Livorno, Feb. 15, 1920.

Up to the present, castor cake has only been used as a fertiliser, as it is poisonous to stock. But Dr. TRIVELLONI has carried out a series of experiments (at the Agricultural Chemistry laboratory of the R. Scuola Superiore of Milan) which have shown that castor cake becomes harmless when heated to at least 115°C. for 90 minutes. In practice, stoving can be replaced by a slight roasting which is more certain to destroy the poisonous principle in the castor cake.

673 - **Fattening Steers on Summer Pasturage in Alabama and Mississippi, U. S. A.** — WARD, W. F., GRAY, D. T. and LLOYD, E. R., in the *U. S. Dept. of Agriculture, Bulletin* No. 777, pp. 24. Washington, July 10, 1919. CATTLE

The Bureau of Animal Industry of the United States Department of Agriculture has carried out experiments on fattening steers on pasture, collaborating with the Alabama Agricultural Station since 1908 and with the Mississippi Agricultural Station since 1915.

Results reported refer to 4 different experiments, 2 in Alabama (in 1912 and 1913, respectively), 2 in Mississippi (in 1915 and 1916, respectively), and concludes with a summary of the results obtained during the four years. The most important data are reproduced in the appended Table.

On comparing the averages of the 3 methods of fattening, it will be seen that there was but a small difference in the average length of the periods of feeding and pasturing.

The average increases in live weight per head per day, which are probably the best data to use in judging the efficiency of the rations, were :— 1.49 lb., for steers on pasture only; 1.83 lb., for steers which, besides pasture, were given cottonseed cake ; 1.53 lb., for steers which received supplementary pasture with a mixture of cottonseed cake and maize meal.

The initial cost of the steers per 100 lb., was the same for each of the 3 groups respectively, in each of the years of the experiment, but in every case the steers in Group I (pasture alone) were sold at the end of the trial at a lower unit price. The difference between the unit prices for the sale of the fattened steers and the purchase of steers for fattening was always in favour of those that received supplementary foods in addition to pasture. This difference was, on an average, 24 1/2 cents per cwt. for Group I, 90 cents per cwt. for Group II, and 81 1/2 cent. for Group III.

The data on the yield on slaughtering are incomplete, but they suffice to show that steers receiving, in addition to pasturage, cottonseed cake or a mixture of this and maize meal gave higher percentage yields on slaughtering than those which had pasturage only.

The steers in Group I (pasture only) made an average profit of $5.78 per head, against $6.23 for those receiving pasture plus cake, and $6.48 for those that had pasture plus cotton cake plus maize. The average profit made by the group that received cotton cake as a supplement would have been much higher had not the average been reduced by the loss that occurred in 1916; the poor result in that year was due to various circumstances and to the use of steers of low value.

Valuable information can be extracted from the appended Table, which shows that the steers in Group I gave a very cheap gain in live weight, the total gains, however, being low, whilst the steers were not highly finished. This lack of finish resulted in a lower unit sale price and a lower percentage yield on slaughtering, so that the gain made by this group was less than that made by the other groups.

The steers in Group II gained weight more rapidly than those in Group I, but the gain cost more. They attained a better finish, however, gave a greater percentage yield on slaughtering, and were sold at a higher unit price, thus compensating for the rather high cost of producing a unit of gain in live weight and leaving more profit per head than the steers in Group I.

Group III only contained two sub-groups of steers, one of which received besides pasture and cottonseed cake, maize meal, whereas the other was given cob meal; the results are not as conclusive as those given by the first two groups. However, they show that replacing half the ration of cottonseed cake by an equal weight of cob meal gave a smaller gain in live weight at a higher cost. But the steers in this group increased in weight more rapidly, attained a better finish and a higher price, as well as leaving a wider margin of profit per head than those of Group I. On an average, the gain per head was greater for Group III than for the other 2 groups, but, in 1912 and 1913, Group II surpassed Group III in this respect.

Conclusions. — The use of cottonseed cake as a supplement to summer pasture in the southern United States results in a quicker gain in live weight in steers, and these finish off better and more rapidly. On account of their higher finish, steers fed also on cottonseed cake sell at a higher price per unit than those fed on grass alone. The difference between the price

Results of 4 years experiments on the summer fattening of steers.

Group, ration and years of trial	N. of steers per group	Duration of trial	Average total gain in live weight per head,	Average daily gain in live weight per head,	Cost of food per 100 gain in live weight,	Cost of steers for fattening, per 100 lb.	Sale price of fattened steers, per 100 lb.	Difference between buying and sale price, per 100 lb.	Per cent. Yield on slaughtering	Average profit per head.
			Lb.	Lb.					%	
I. *Pasture alone :*										
1912	29	112	117	1.04	$1.71	$3.87	$4.00	$0.13	48,68	$3.47
1913	26	147	240	1.63	1.09	5.25	5.00	.25	—	6.60
1915	20	107	180	1.68	1.06	5.00	5.75	.75	—	7.18
1916	30	134	214	1.60	1.12	5.50	5.85	1.35	51,17	5.88
Average . .	—	**125**	**188**	**1.83**	**1,25**	**4,90**	**5.15**	**.245**	**49,92**	**5.78**
II. *Pasture and cottonseed cake :*										
1912	36	101	129	1.28	$5.32	$3.87	4.75	$0.88	51,62	$4.61
1913	26	147	309	2.10	3.27	5.25	6.00	.75	—	11.23
1915	20	107	214	2.00	3.44	5.00	6.35	1.35	50,80	9.61
1916	30	134	257	1.92	4.54	5.50	6.10	.60	54,21	.05
Averages . .	—	**122**	**227**	**1.83**	**4.14**	**4.90**	**5.80**	**.90**	**52,21**	**6.23**
III. *Pasture + cottonseed cake and maize flour in equal parts :*										
1912 (maize meal)	25	106	143	1.35	$5.14	$3.87	4.75	$.88	51,91	4.69
1913 (cob meal)	25	147	252	1.71	3.51	5.25	6.00	.75	—	8.27
Averages . .	—	**126**	**198**	**1.53**	**4,32**	**4.56**	**5.37**	**8.15**	**51,91**	**6.48**

per unit of live weight of the fattened animal and the animal before fattening is nearly always increased when the pasture is supplemented with cottonseed cake or with cottonseed cake plus maize meal.

Steers that are not of selected quality may yield a higher profit when fed on pasture alone than when given supplementary foods as well as pasture, especially if kept on good pastures that are not expensive.

The cost of increasing the unit of live weight of steers on pasture becomes much higher when cottonseed cake is fed, but the higher price fetched by steers thus fattened compensates for the increase in cost due to the cake and leaves a higher average profit than that yielded by steers fed solely on pasture.

The substitution by maize meal of half the supplementary ration of cottonseed cake given to steers on pasture gave an increased live weight and a finish comparable to that given by cake alone ; but if maize meal does not cost less than cottonseed cake, it should not be used as a substitute. A mixture of equal parts of cake and cob meal, as a supplementary ration for steers on pasture, is less effective in producing the unit increase in live weight than cake alone or a mixture of maize meal and cake. When maize is cheap, it should preferably be given as grains or maize flour rather than as whole cobs.

When animals on pasture are given cake, the pasture utilises a large quantity of fertilising material that passes into the dung.

One of the distinct advantages of supplementing the pasture with concentrated foods is that the animals thus treated finish more rapidly and can be sold sooner than steers fed solely on pasture ; i. e., they can be sold before so many are placed on sale that the market price is affected. Moreover, when stock is sold quickly, the pastures have time to recover and will furnish good pasturage for other cattle in the autumn.

Steers of inferior quality do not respond quickly to the use of choice foods and, even if well fattened, do not fetch as high a price as well-bred animals of the same degree of fattening. Again well-bred or pure-bred cattle make better use of the food, fatten more quickly and always fetch better prices than inferior animals of the same weight. The better the quality of cattle, the more they should be given high-priced foods.

When bulky foods such as silage, hay, straw, cotton pods, etc., are available and when steers are to be fattened on summer pasture, it is advisable to buy the animals in autumn and winter them on roughage plus a little cotton cake rather than buy them in spring for fattening during the grazing season.

674 – **Winter Feeding of Cattle in Montana, U. S. A.** — ARNETT, C. N., in the *University of Montana Agricultural Experiment Station, Bozeman, Montana, Circular* 85, pp. 7. Bozeman, August, 1919.

In 1916-17, 1917-18, and 1918-19, the Montana Agricultural Experiment Station carried out experiments on the winter feeding of adult cattle ; the winter was very short and mild in the third period. The experimental animals were full-blooded descendants of Shorthorns and Herefords. They were kept on pasture during summer and on stubble during autumn. In the winter they were protected from the weather and thus required less food for maitenance. In addition a salt lick and relatively lukewarm drinking water were always available. The average results of the three winters are given, those of the first two being kept separate from those of the third.

CONCLUSIONS. — Cheap roughage such as straw can be used to advantage in wintering breeding beef stock. In mild winters and when the animals have a fair amount of flesh by autumn, straw may constitute the sole food during wintering. A ration of straw supplemented with 5 lb., of hay per head per day will enable good, strong animals that are not milk-

ing to pass the winter in good condition. The difference in condition at the end of winter between animals that were given a supplement of 5 lb., of hay and those that received double this amount was not sufficient to justify feeding the larger quantity of hay.

Results of hibernating cows on different rations.

Ration per head	Duration of experiment, (days)	No. of head	Average initial weight, in lb.	Average final weight, in lb.	Average loss per head in lb.
Averages of the winters 1916-1917 *and* 1917-1918.					
Straw alone	155	24	1229	1035	194
Straw + 5 lb. hay	155	24	1229	1134	95
Straw + 10 lb. hay	155	24	1229	1166	58
Winter 1918-1919.					
Straw alone	132	12	1132	1066	66
Straw + 5 lb. hay	132	12	1155	1143	12
Straw + lb. cottonseed cake	132	12	1146	1136	10

In the 1918-19 experiment, lb., of cottonseed cake was found to be roughly equivalent to 5 lb., of a good mixed alfalfa and timothy hay as a supplement to oat and barley straw in wintering breeding beef stock. The cattle that were given cottonseed cake as a supplement consumed relatively more straw than those that received hay as a supplement.

675 - **Experiments on the Feeding of Draught Oxen, in the Philippines.**—Lago, F. P., in *The Philippine Agriculturalist*, Vol. VIII, No. 3, pp. 79-91. Los Baños, Oct., 1919.

The experiments, carried out at the College of Agriculture, Los Baños, lasted two years and had the aim of ascertaining the foods best suited as supplements to the pastures in the Philippines for draught oxen. The oxen used in the experiment belonged to the Chinese, Indo-Chinese, and native breeds, their ages varied from 6 to 13 years, and they weighed about 375 kg. The native pastures contain the following species :— *Imperata cylindrica, Paspalum conjugatum, Saccharum spontaneum, Andropogon halepensis, Rottboellia exaltata, Mimosa pudica, Panicum* spp., *Cynodon dactylon, Leucaena glauca, Digitaria consanguinea*, and *Dromodium triflorum.*

Five experiments were carried out :— (1) Comparison between pasture alone and pasture supplemented with maize cobs ; (2) Comparison between pasture supplemented with sugar-cane tops and pasture supplemented with maize forage ; (3) omparison between native pasture supplemented with Guinea grass (*Panicum altissimum*) on the one hand, and pasture with maize forage on the other ; (4) Comparison between native pasture supplemented with Japanese cane and pasture with maize forage ; (5) Comparison between Japanese-cane and maize forage. The results of these experiments are summarised in the following table :—

Comparison between supplementary rations given to oxen on pasture.

Experiments	Foods	Number of animals	Total supplements consumed,	Duration of working days	Total number of useful working days	Total gain (+) or loss (—) in live weight,
			Kg.			Kg.
I: Aug. 25 - Oct. 19, 1917	Maize + pasture	5	262.24 *	56	99	— 20.04
	Pasture alone	5	—		99	— 20.20
I: Oct. 20 - Dec. 14 1917	Pasture alone	5	— *	56	96	— 86.4
	Maize + pasture	5	211.46		96	— 42.1
I: Dec. 15, 1917– Jan 14 1918	Pasture alone	5	— *	30	54	+ 25.32
	Maize + pasture	5	170.00		54	+ 16.45
II: Mar 16 - Apr. 26 1918	Sugar-cane tops + pasture	5	612.15	42	88	+ 14.7
	Maize-forage + pasture .	5	1190.71		88	+ 25.5
III: Aug. 17 - Sept. 28 1918	« Guinea grass » + pasture	4	944.48	42	88	+ 23,3
	Maize-forage + pasture .	4	1314.9		88	— 1.9
IV: Nov. 9 - Dec. 14 1918	Japanese cane + pasture.	5	498.3	35	75	— 26.6
	Maize-forage + pasture .	5	1245.8		75	+ 31.6
V: Jan. 6 - Jan. 31 1919	Japanese cane	5	2853.19	26	77	— 2.29
	Maize-forage	5	3826.39		77	— 5.05

* Grain.

The author has concluded from these results that feeding maize cobs in quantities corresponding to 0.2, 0.3 and up to 0.5 kg. of maize per day to draught oxen weighing about 375 kg., had no particular advantage as a supplement to natural pasturage (the supplement was only given when the oxen were working). It is possible that the small differences in favour of the group which was given maize might have been due to insufficiency of the pasture and that the animals given no supplementary ration might not have been given sufficient food.

Maize forage was a better supplement than sugar cane, the difference being mainly due to the relative tenderness of the maize, as this enables the animal to make a complete meal of it. The sugar-cane tops, although palatable, were so hard that the animals could not consume enough to make a complete meal.

Guinea grass was slightly better than maize forage as a supplement to pasture.

Maize forage was better than Japanese cane (entire plants were used which were, at the beginning of the experiment, 75 cm. high) as a supplementary food. One group of oxen was given Japanese cane exclusively for 26 days and another group was given maize forage exclusively ; both groups gained slightly in weight, the latter a little more than the former.

The author bases the following advice on these facts :— (1) When the grass of the natural pasture is abundant and succulent and when the animals have sufficient time for eating and resting, a supplement need not be given ; (2) animals doing hard work must be given supplementary foods if they are not left long at pasture ; these foods may be maize forage, Guinea grass, or sugar-cane tops ; maize forage being preferable because it supplies more assimilable food ; Japanese cane should be reserved for the dry season, during which it remains green and juicy ; (3) maize for use as forage should be sown somewhat thickly. This develops finer and smaller stalked plants, softer in texture, with few or no cobs, whilst the food materials are more evenly distributed throughout the plant.

676 - **Pig Feeding Experiments with Various Fodder Plants, in Montana, U. S. A.** PIGS
— ARNETT, C. N. and J,OSEPH W. E., in : — I. *University of Montana, Agricultural Experiment Station, Bulletin* No. 128, pp. 61-106, figs. 7. Bozeman, Feb., 1919. — II. *Circular* 83, Jan., 1919.

The Bulletin 128, of which the circular is largely a summary, consists of two parts, the first of which deals with the economic utility of feeding different amounts of grain to weaned piglets put out to pasture. The following experiments are described :— (1) Comparisons of rations consisting respectively of 1,2 and 3 lb. of barley per 100 lb. of ground live weight given to piglets put out to pasture on alfalfa during 104 days of the year ; (2) a similar comparison with 29 piglets during 178 days in 1915, followed by a complementary period with barley, feed wheat, and tankage (75 : 25 : 8) until each one had attained an average weight of 200 lb. ; (3) comparison between a ration without grain, the barley being given in a pig feeder, and rations of 1, 2, and 3 lb. of barley per 100 lb. of live weight given to 42 piglets pastured on red clover for 90 days in 1916, followed by a transition period of 30 days with pasture and a complete barley ration, and a complementary period without pasture and with barley and tankage in the ratio 25 : 2 ; (4) a similar comparison with 43 piglets in 1917, a year in which the pasture season lasted 110 days and the transitional period 20 days; (5) comparison between a ration of 1 lb. of barley per 100 lb. of live weight and a ration of lb. per cwt. of barley per head per day, made with 18 piglets at pasture on clover for 90 days in 1918, followed by a transition period of 20 days and a complementary period. In the second part of the Bulletin comparisons are made between various forage plants for weaned piglets which were also given barley at the rate of 2 lb. per 100 lb., of live weight ; the comparisons were :— (1) Between rape or barley, or rape with oats, or oats ; 28 pigs were used in the experiments in 1915 ; (2) between red clover or sweet clover pasture or rape ; these experiments were carried out in 1917 with 33 pigs.

In another experiment carried out in 1918, the pigs were kept in a meadow consisting of meadow-grass and white clover, and given 1lb., of barley per head per day. The results, given in Tables I and II permit of the appended conclusions.

Alfalfa pasture is better for young pigs than red clover pasture ; it was the only satisfactory annual fodder plant out of all those tested. When 1 lb. of barley is given with tankage as part of the supplementary ration, the best economic results are obtained.

TABLE I. — *Results of feeding different amounts of barley to weaned pigs at pasture on* ***alfalfa*** (137 *days*) *and clover* (100) *days.*

Barley ration	Pigs per acre	Length of the complementary period without pasture	Gain in weight per head per day	Lb., of forage consumed per lb. of gain		Cost of forage and pasture per 100 lb. of gain	Profit per head
				Barley	Tankage		
		days	lb.	lb.	lb.		
Alfalfa pasture :							
1 lb. per 100 lb. live weight . .	14	—	0.43	1.23	—	$6.26	$1.89
2 lb. per 100 lb. » » . .	15	—	0.60	2.09	—	8.00	1.68
3 lb. per 100 lb. » » . .	17	—	0.73	2.84	—	9.78	0.81
Clover pasture							
Without grain	16	103	0.81	3.29	0.24	$11.45	$2.18
1 lb. per 100 lb. live weight . .	19	101	0.84	3.32	0.22	11.39	2.59
2 lb. per 100 lb. » » . .	21	95	0.88	3.48	0.20	11.67	2.01
3 lb. per 100 lb. » » . .	25	81	0.94	3.57	0.16	11.76	1.80
Self-fed	30	70	1.01	3.87	0.12	12.41	0.82

Favourable results were obtained by giving 1lb. of barley per head per day and, although the pig is small, this quantity is sufficient. The average of two experiments with alfalfa pasture (neglecting the complementary period) and the averages of two experiments with red clover pasture are given in table I.

In working out the costs, the following prices (taking the *dollar* at par) were used :— Barley, $3 per cwt. ; tankage, $2.75 per cwt. alfalfa pasture, $20 per cwt, initial cost ; clover pasture, $25 per acre in 1916 and $20 per acre in 1917 ; initial cost of pigs, $20 per 100 lb. of live weight ; cost at end of pasture season $13 per 100 lb. cost at end of complementary period, $14 per 100 lb.

Table II gives the averages of the results of the two experiments with rape pasture and those of the experiments carried out in 1915 with pasturage on barley, oats, rape associated with oats. The receipts are

all calculated on the basis of the increase in live weight of the pigs, which was taken at 148.52 fr. per quintal.

TABLE II. — *Comparison between different pasturages for weaned piglets also receiving 2 lb. of ground barley per 100 lb. of live weight.*

Pasture	Pigs per acre	Duration of pasturage,	Average increase in weight per head per day	Barley consumed per lb. of increase in live weight,	Cost of forage and pasture required for 100 lb. gain	Cost of pasture	Returns per lot	Profit per head
		days	lb.	lb.				
Rape	35	100	0.54	2.65	$10.36	$ 9.25	$0.82	$—0.12
Rape + oats	35	100	0.43	3.14	12.93	10.50	—10.66	—1.52
Oats	35	77	0.47	2.81	12.37	10.00	— 9.26	—1.32
Barley	35	77	0.42	3.06	13.60	10.00	—12.16	—1.74

677 – **Influence of Feeding Ducks with Rice and Maize on their Growth and Egg-Production.** — ALCASID, E. E., in *The Philippine Agriculturist*, Vol. VII, No. 8, pp. 255-266. Los Baños, March, 1919. POULTRY

All the domestic breeds of ducks are considered to be derived from the wild Mallard, *Anas boscas*. It is believed that the domestic duck of the Philippines is of Chinese origin and has been introduced comparatively recently by Chinese immigrants. Generally speaking, the Philippines offer favourable conditions for breeding ducks, and, at certain places, e. g. at Pateros (Luzón) and district, duck breeding is a well established industry.

The author has examined : — (1) The effect of various foods on the growth and egg-production of the duck ; (2) the effect of castrating the drake and the reaction of the castrated drake to various qualities of food ; (3) the possibility of rearing ducks in places where a pond to swim in and abundant animal food are not available.

In the Philippines, natural incubation, by means of hens, is used and it is believed that the ducklings hatched out in this way are stronger. Artificial incubation would give equally good results, but it would have to be in charge of competent persons.

Experiment I. — A group of 9 ducklings aged 67 days was fed on a mixture of 3 parts of rice meal + 2 parts of rice bran + 135 gm. of snails per day ; in a second group of 9 ducklings, of the same age, the rice meal was replaced by an equal weight of maize meal. Three meals a day were given during the first 41 days of the experiment and, during the remaining 83, two meals were given, the weight of snails being increased to 200 gm. per day. At the beginning of the experiment, the average weight per head of Group I was 392.44 gm. ; the weight at the end of the experiment, which lasted 32 weeks, was 1024.87 gm., the average gain per head per week being 23.84 gm. In the second group, these figures were, respectively, 426.55 gm., 1080,00 gm., and 23.91 gm. There was thus hardly

any difference between the two groups in respect of the quickness of growth.

The age at which the ducks in Group I laid the first egg was:— Maximum, 193 days; minimum, 189; average, 191; for the second group the ages were, respectively, 207, 191, and 199. These ducks were hatched on February 2, i. e., in the rainy season, which is considered to be unfavourable for the growth of the duck. According to breeders in the Philippines, well-kept ducks lay their first egg, that is, attain sexual maturity, in the fourth month; if not treated properly; however, this may be delayed until the ninth or tenth month.

During the first laying period (August to February), three ducks in the first group laid in all 78 eggs of an average weight of 50.50 gm., and 3 ducks in the second group laid 39 eggs of an average weight of 52.34 gm. As regards the number of eggs laid, feeding with rice meal was clearly superior to feeding with maize meal.

Experiment II. — This was a repetition of Experiment I, with the difference that the ducklings were only 14 days old at the beginning of the experiment; the results, which confirm the first ones, are therefore more pronounced for the various groups. During their first 12 weeks of life, the ducklings in Group I (fed on rice meal and rice bran) made an average gain in weight of 17.72 gm. per week per head. From the 13th to 45th week, the average gains per week per head were, respectively, 26.33 gm. and 14.52 gm. For this second period, a third group was also formed, half of it being ducks from Group I, and half from Group II; besides rice bran, maize meal and rice in equal parts were fed. The third group made an average weekly gain in weight of 19.01 gm. per head. Sexual maturity was attained in 215, 298, and 287 days for each of the three groups, respectively.

The nature of the food had a marked effect on the colour and taste of the eggs. Ducks fed on rice meal and rice bran laid eggs, of a clear yellow colour, whilst those fed on maize meal and rice bran laid eggs with yolks that became of a dark orange colour when fried and a light orange when boiled. The eggs of ducks fed on rice meal and rice bran had a slightly greenish shell and had a somewhat putrid flavour when cooked; those of ducks fed on maize meal and rice bran mostly had a white shell and had a normal flavour when cooked.

The ducks which had a pond at their disposal laid eggs with a higher degree of fertility than those of ducks that had no pond; the first method is thus preferable for eggs that are to be incubated.

678 - **Ostrich Rearing in Sardinia.** — Ottolini, R., in *Bassa Corte* (1), Year 1, Part. 3 pp. 109-112, figs. 4. Piacenza, Feb. 5, 1920.

An ostrich farm has been established at Baccarasa (in the Tortoli district, province of Cagliari), a locality situated to east of the Tortoli

(1) According to the first number published (Jan. 5, 1920) of the periodical, *Bassa Corte*, the object of this publication is to further the rearing of farm animals such as pigs, sheep, etc., as well as the smaller agricultural industries, so as to help to increase the production of

Arbatase railway, in a wide plain bounded on one side by the sea and on the other by the Ogliastra mountains. The site, covering some 50 hectares, consists mainly of a deep, very permeable, sandy soil, covered with bushes of rock-roses and cork oaks. The birds are kept in enclosures in pairs or in groups, according to their age and the temperature. The enclosures are made by stretching iron wires 30 cm. apart on reeds planted vertically every 25 cm., and on juniper stakes spaces 3 cm. apart. The height of the fence is about 2.5 metres and the enclosure has an area of 50 × 80 m. for pairs and more for groups. The enclosures are separated by paths planted with trees and oach enclosure is provided with a house where the birds can shelter during bad weather and lay their eggs.

The houses are divided into two parts by a temporary partition; one part has a concrete floor, and the other is covered with a thick layer of sand in which the birds can dig a hole 50 or 60 cm. deep. The hen lays its eggs and hatches them, helped by the cock, in this second part. The cribs and watering places are placed around and inside the houses. A separate building contains the incubator room and that for rearing the chicks, both rooms being provided with means of heating and outside runs where the chicks can go during the warm hours of the day. The staff includes 3 agricultural labourers and 2 men who prepare and distribute the food. The incubator room and the chicks are looked after by the director's family.

A pair aged at least 2 years is chosen and isolated in an enclosure; the hen begins to lay at about the end of February and continues to lay until the end of June, one hen laying from 12 to 20 eggs in a season. Artificial incubation begins as soon as the first eggs are laid, as the season is still cold and renders natural incubation difficult. Towards the end of May or beginning of June, the eggs are left entirely to the care of the parents, who hatch out the eggs themselves.

About 60 % of the eggs hatch, whether the incubation is natural or artificial, the former having no advantage over the latter, even as regards the strength of the chicks. Incubation lasts between 40 and 45 days. The most difficult period is that following on hatching, after which the ostriches are not subject to any disease, even of an infectious nature. They are affected by sudden changes in temperature, however, and they are consequently kept in their houses on rainy days or nights. They rarely suffer from indigestion, except when the temperature drops suddenly; the remedy consists in administering purgatives, particularly sulphate of magnesia dissolved in water.

The food varies according to the age, season, breeding and brooding time. The first meal is given 5 days after hatching, and consists of a mash of chopped raw meat, bone powder, and lucerne. The meat is gradually

meat in Italy. The following subjects will be dealt with in the periodical :— Economic problems of rearing; pig breeding; sheep breeding; rabbit breeding; poultry keeping; bee keeping; sericulture; hunting dogs; fish breeding; snail breeding; mushroom growing; smaller agricultural industries; review of the chief Italian and foreign periodicals; market reports. (*Ed.*)

replaced by grains (wheat, barley, oats, maize), acorns, beans, chopped ha (especially lucerne), all kinds of grass, fruits of cactus (*Opuntia*), gourd turnips, tubers, mulberry leaves, elm leaves, etc. During brooding an ovulation, a richer and more concentrated ration of forage is given. Dr or green forage must always be chopped up before being fed to the birds The weight on hatching is about 1.5 kg., whilst the adult ostrich weigh about 100 kg., and stands 2.8 to 3 metres high.

At hatching, the plumage on the body is grey and striped in the di rection of the length, with alternate light and dark bands, on the hea and neck. The feathers at first aculeate, have longer vanes at 3 months At one year, the male colours can be distinguished from those of the fe male :— the upper half of the neck and legs loses all the plumage or onl retains a slight down ; the black feathers grow on the body and the whit feathers on the wings and tail. The females retain their grey colou Gathering the feathers can be begun at an age of one year and a few month and is repeated each year in September and October. The method is a follows :— The ostrich is taken by the neck by means of a special iron hool and 2 men hold it taking care to avoid kicks (the only dangerous defenc possessed by the ostrich), whilst another man cuts off the feathers 3-5 cm above the skin ; 3 months after, the stumps are removed without pain b the ostrich itself and a month later, new plumes begin to appear.

The cock furnishes some 40 white and 40 black feathers, and the he an equal number of grey ones. The first feathers that cover the bod are not cut, but are collected when the bird moults. The largest whit feathers are 50-60 cm. long and 20-25 cm. wide, and the tail feathers a about half as long and wide as the wing feathers. The grey feathers c the female are the same length and breadth as the corresponding feathe of the male.

BEE-KEEPING

679 – **Aluminium Honeycombs.** — WESTBROOKE, G. V. (Apiary Instructor, Auckland in *The New Zealand Journal of Agriculture*, Vol. XX, No. 2, pp. 118-119, fig. 1. Wellington, Feb. 20, 1920.

The Horticultural Division of the New Zealand Department of Agr culture has made experimental use in its hives at Tauranga and Ruakur of the aluminium honeycombs now in use in the United States. In Eng gland, thin sheets of aluminium are on sale which can be given the hone comb shape by means of the roller used to stamp the sheets of wax.

The trial in New Zealand showed that the bees at once made use the metal honeycomb which can serve both as brood chamber and hone store. As a larger proportion of nectar is converted into honey, the yie is greater. It remains to be seen whether the metal honeycomb wou have disadvantages for wintering under a severe climate.

SERICULTURE

680 – **The Improvement of Sericulture in Jugo-Slavia.** — *Bulletin des Soies et des So ries*, Year XLIV, No. 2236, p. 3. Lyons, April 3, 1920.

A conference has been held at the Jugo-Slav Ministry of Agricultu at Belgrade for the improvement of sericulture in Jugo-Slavia. In cons quence of the resolutions passed at the conference, the Commissariat f

political economy convened a meeting of the owners of sericultural establishments, i. e., the representatives of the Croat Agricultural Bank and of the Association of Syndicated Serbian Peasants, in order to outline a scheme for the improvement of sericulture in Croatia and Slavonia. After a long discussion, the following resolutions, *inter alia*, were passed:— (1) To make a census of all the mulberry trees in the country; (2) to plant mulberry trees in meadows; (3) to enforce the regulations concerning the protection of mulberry trees; (4) to raise mulberry trees in the horticultural schools; (5) to buy silkworm eggs; (6) to establish local commissioners to inspect and direct sericulture, in the place of the present district inspectors; (6) the organisation of a collaboration with the central administration, which should be established on behalf of whole State and be centred at Novisad; (8) to ask the expert women workers at Cjevgjelija to instruct the peasant women in the rearing of silkworms; (9) the foundation of as many Sericultural Associations as possible; (10) in the order to be issued regarding this subject by the Ministry of Agriculture, the interests of sericulture in Croatia and Slavonia must be safeguarded.

681 – **The Use of Fertilisers in Rice Fields and Fishing.** — BERNARDI, B., in *Il Giornale di Risicoltura*, Vol. X, No. 2, pp. 24-28. Vercelli, Feb. 29, 1920. FISH-BREEDING

As fishermen have stated more than once that the use of fertilisers on soil leads to a diminution of the fish population in watercourses and basins into which the irrigation waters from such soils (rice fields and "marcite") flow, the author has investigated the question.

Neglecting basic slag, which of late years has been almost entirely lacking on the Italian market, the fertilisers used in rice fields are :— Superphosphates, sulphate of ammonia, calcium cyanamide, sulphate of potash, sulphate of lime; these are respectively applied at the rate of 3-4.5, 1-2, 1-2, 0.5-1 quintal per hectare.

The fertilisers are usually applied after the last ploughing and shortly before the first seeding, with the exception of sulphate of ammonia, half of which is applied at sowing time and half after the first weeding. Ridged rice fields may be given an average depth of water of some 15 cm., which corresponds to 1500 cu. m. of water per hectare. Consequently, even on admitting, which is absurd, that the fertilisers incorporated in the soil by hoeing undergo no changes, fertilisers applied in the proportions mentioned above would give, per litre of water:—

Superphosphate.	0.200 — 0.300 gm.
Sulphate of ammonia	6.066 — 0.130 gm.
Cyanamide	0.066 — 0.130 gm.
Sulphate of potash	6.033 — 0.066 gm.
Sulphate of lime	0.330 gm.

The question is, whether the fertilisers can harm fish in these concentrations. To ascertain this, the author kept trout and carp in water containing each of the fertilisers separately, beginning with the lowest concentration and ending with the highest.

The observations on superphosphate were made with the liquid obtained by lisciviating 50 gm. of the fertiliser (content 14-16 %) with half a litre of spring water; the liquid was afterwards diluted with various amounts of spring water. No signs of disturbance were shown by fish placed in water containing 2-4 % of the liquid, but in water containing at most 6 % of the wash water, the trout showed a certain agitation and finally died.

Sulphate of ammonia begins to be harmful at the strength of 0.26 gm. per litre, whilst cyanamide, harmless at strengths of 0.13 and 0.26 gm. per litre, is harmful at a concentration of 0.52 gm. per litre. Sulphate of potash does not harm fish, even at greater strengths than those mentioned above, i. e., even at strengths of 0.93 and 1.8 gm. per litre.

In another experiment, the cumulative effect of the various fertilisers was tested, using solutions with concentrations that corresponded to the maximum rates mentioned above. Fish and even shrimps lived in them in excellent health for long periods.

Sulphate of lime, even at a strength of 2 per 1000, is known to have no injurious action on fish.

It can therefore be concluded that the irrigation water from rice fields has no injurious action on fish and shrimps, and this is supported by the fact that, owing to its absorption power, the soil retains a large proportion of the fertilisers and that the water from the rice fields becomes diluted in the waters of streams, etc.

All that can be suggested is that the irrigation water from rice fields to which fertilisers have been applied may induce less favourable conditions of life for fish in the ponds into which they drain and that the fish may be forced to seek more favourable surroundings. Again the possibility that the fertilisers may act mechanically on the gills of the fish and prevent them from functioning normally can be excluded, because they are not carried away in the irrigation waters, which remain clear. Nor can it be thought that, owing to incorporation of the fertilisers in the soil, products more toxic than the fertilisers themselves are produced.

682 – **The Purification of Waste Waters.** — Carré, Prof., in the *Bulletin Suisse de Pêche et de Pisciculture*, Year XXI, No. 1, pp. 4-6. Neuchâtel, Jan., 1920.

The known methods of purification are either useless or not generally applicable in practice. As manufacturers cannot be forced to use a practical method for purifying waste waters, legislation is without effect and even irritating. The author believes that human methods for purifying waters should correspond with the mechanism by water spontaneously purified under natural conditions.

Colloidal clay is a natural purifier of water, the purification being due to the simultaneous precipitation of flocculated clay and the fermentable organic matter which is the essential cause of the contamination of water. The clay is flocculated only in water in which small quantities of salts of sodium, calcium, etc., are dissolved. If sufficient liquid manure is added to a test-tube containing water to colour it distinctly, and the tube is then

lled up with water containing a little suspended clay, the addition of a ew drops of a solution of common salt will, after shaking and allowing to tand for a few moments, precipitate the clay which will drag down with all the suspended matter as well as the organic colouring matter. This rocess could be used practically in the following way :—

(1) The waste water is run into purifying tanks after been treated ith an amount of colloidal clay that is mechanically proportional to the olume of water requiring purification ; (2) it is next passed into settling anks where the water becomes clear on standing ; it is finally run off hrough sluices into adjacent watercourses ; (3) the fermentable deposits an be made into composts, nitrification being assisted by mixing with lenty of lime or marl.

83 – **Young Fresh-Water Stages and Biology of the Lamprey (*Pteromyzon marinus*).** — LÉGER, L., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 4 (Jan. 26, 1920), pp. 251-254. Paris, 1920.

Contribution to the study of the life cycle of the lamprey, which is as et almost entirely unknown. The author has been able to distinguish periods in the normal life of the lamprey which swim up the watercourses f central France, particularly in Vienne and the Indre ; these periods are s follows :—

(1) Larval period in fresh water lasting at least 4 or 5 years, with ixed food (vegetable and animal micro-organisms) and ending by metamorphosis, from which emerge young lampreys, 16-20 cm. long, already howing adult characters ; these go down to the sea at the end of autumn with eels accompanying their descending migration.

(2) Period of growth in the sea, on an animal diet ; this period is pparently shorter, judging by the rapidity of growth of other potamotoctic ish such as salmon, and leading up to sexual maturity.

(3) Sexual period, with decreasing and finally no food, marked by he beginning of the return to the rivers, often with shoals of shad and almon ; this period is still shorter if it is admitted, with the author and many other observers, that the nuptial journey in fresh water is the last tage of their existence.

84 – **The Minimum Quantity of Water required to a Few Salmon at a Constant Temperature of 12° C.**— HESSE, E., in the *Bulletin Suisse de Pêche et de Pisciculture*, Year XXI, No. 1, pp. 6-8. Neuchâtel, Jan., 1920,

From observations made in the Piscicultural Laboratory of the University of Grenoble, the author draws the following conclusions, which are of importance for rearing in a limited area :—

(1) Renewal of the water at the rate of 2 litres aminute is necessary and ample for succesfully rearing a hundred odd trout, of 1, 2 or more years, in an aquarium containing 400 litres of water kept at a constant temperature of 12° C., and with a free surface of about 1 sq. metre, but this is a *minimum* quantity, below which there is a chance of mishaps.

(2) In water kept at this temperature, fountain salmon resist asphyxiation better than rainbow trout.

(3) In these conditions of limited space and low renewal, *Salmo salvelinus* gives the best yields up to the beginning of the second year if it is not mixed with other species ; then come rainbow trout and fountain salmon. Apparently, the native trout does not grow nearly so well as the preceding species.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

685 - **Colonial Power Farming** (1). — MAGEN (Head of the Agricultural Service of the Institut Scientifique of Indo-China), in the *Bulletin de l'Institut Scientifique de Saïgon*, Year II, No. 3, pp. 65-68, fig. 1. Saigon, March, 1920.

Power farming is perhaps more necessary in the colonies than in temperate countries, for if the latter possess powerful farm animals, this is not so in hot climates. Moreover, epizootic disease is infinitely more frequent and severe in tropical than in temperate regions, as hygienic conditions are not as good and inspection is not so efficacious.

Indo-China is favourably placed for power farming as the Annamites have a remarkable gift for mechanics. Thus, when the author gave a power-farming demonstration in Indo-China, on January 30 and 31, 1920, using a Caterpillar tractor, a Bajac plough, a Tracford, a Norwegian harrow and a scarifier, it was found that the Annamites, after only 5 or 6 days' training, managed the machines quite well.

Besides, without mechanical aid, it is impossible to work the ground properly in the colonies, as, the average type of oxen available cannot draw a plough cutting at a depth of 20 cm. This is so true that the administration of the Belgian Congo organised, in 1912, a power-farming competition for 1913 in Belgium that was extremely successful.

Cost is a secondary consideration and, in fact, the author calculated that ordinary ploughing under average conditions required some 36 litres of petrol, costing about 7 *piastres* per hectare, so that if an extra 100 kg. of paddy or 7 kg. of rubber per hectare are gathered, the fuel will be paid for.

The author has studied the existing types of tractor and has arrived at the following conclusions :—

In most cases, cultivation can be divided into 2 phases : ploughing and complementary work. Two types of tractor should correspond to these two phases, i. e., 30-40 H. P. tractors with great gripping powers for ploughing, and light 15-20 H.P. tractors for complementary work. With certain permanent crops, however, such as rubber, coffee, etc., which do not require deep ploughing, tractors of only 15-20 H.P. will be required for ploughing, the harrowing being done by oxen.

It has been claimed that a powerful tractor can simultaneously draw ploughs, harrows, etc., over a width of 8 or 10 metres ; this may be true in countries with immense stretches of very homogeneous soil, but it is im-

(1) See the trials on the mechanical cultivation of rice carried out in Cochin-China in 1919, and summarised in *R.*, 1919, No. 508. (*Ed.*)

practicable in rubber or coffee plantations or in rice fields split up into plots of 4, 5, or 10 hectares at the most.

A type of tractor should be chosen that is best suited to the conditions and the crop which is under consideration.

586 - **The Spring Power Farming Week** (1). — PASSELÉGUE, G., in the *Journal d'Agriculture pratique*, New Series, Vol. 33, 1920, Vol. I, Nos. 12-13, pp. 221-223. Paris, March 18-25 1920.

The "Chambre Syndicale de Motoculture" of France organised an international power-farming exhibition, which was held on March 4-14, 1920 on the Terrasse des Tuileries at Paris.

Only 39 machines were exhibited, including 19 French, 15 American, 1 English, 2 Italian, 1 Swiss and 1 Czecho-Slovak. A cursory account is given below.

CABLE SYSTEMS. — DE DION-BOUTON Co: two 50 H.P. motor-windlasses.

The A. DOUILHET Co. exhibited the ploughing set with two motor-windlasses, formerly shown by FILLET ET CIE. Each windlass, weighing 750 kg., is actuated by a 12 H.P. internal-combustion engine running on petrol. The drum has three different radii, so that the cable can be wound at 1, 1.5 and 1.8 metres per second, according to the part of the drum on which the cable is being wound. The machine can be used in a vineyard by fitting a crutch on the implement being drawn so that the cable is unrolled between the vines in the space that is to be worked next.

Société française des tracteurs-treuils DOIZY: a 25 H.P. windlass tractor.

Matériel de culture moderne: a 40 H.P. FILTZ-GRIVOLAS haulage tractor that is designed so as to diminish the couple resulting from attaching the implement laterally. The same company exhibited a 2-furrow double brabant, which they described as a plough with differential earthing and automatic lift; the stanchions of the axle are articulated with the beam and the drive acts through the axle, so that when the pull ceases at the end of the furrow as the tractor stops, the axle is pulled towards the mould-boards by two strong springs, thus automatically lifting the ploughs, so that the attendant has less to do. The company also exhibited a new 3-furrow balance plough which has automatic steering.

TRACTORS WITH ONE DRIVING WHEEL. — AGRICULTURAL Co.: 24 H.P. *Taureau* tractor.

AMERICAN TRACTOR Co.: 40 H.P. Gray tractor, which has been successfully used for cultivating rice-fields, the steering wheels being fitted with iron sheets to cover up the spokes.

TRACTORS WITH TWO DRIVING WHEELS. — AGRESTIC MACHINERY Co.: WHITNEY tractor with an 18 H.P., 2-cylinder horizontal engine running at 750 revs. per minute, and with 3 speeds: 2.8, 4 and 6.4 km. per hour

(1) See *R.*, March, 1920, No. 354. (*Ed.*)

and a reverse. It weighs 1300 kg. and the driving wheels have tyres 25 cm. wide. Angle-irons are fitted to give grip on the soil.

AGRICULTURAL Co. : 16 H.P. HAPPY FARMER tractor.

BEAUVAIS & ROBIN Co. : 30 H.P. AMANCO tractor, also known as the JOHN DEERE tractor.

BERNA Co. : 40 H.P. BERNA tractor.

CH. BLUM & Co. : 35 H.P. TOURAND-LATIL tractor. In previous models the plough was rigidly attached to the tractor, thus constituting a motor plough. As this practice had defects, a more supple attachment, consisting of a chain, has been provided. The manufacturers took some time before they devised this improvement on their first models, although the question had been settled long before by M. RINGELMANN in his studies on Mechanical Cultivation.

FRENCH CASE Co. : 18 H.P. CASE tractor.

M. CHAPRON has provides his vineyard tractor with a more powerful engine and higher wheels, whilst the gripping strakes are fixed on to an extra tyre which is in two pieces and attached to the wheel by wing-bolts. The grip of the steering wheel is obtained by weighting the end of the frame with cast iron.

Compagnie internationale des machines agricoles (C. I. M. A.) : 16 H.P. INTERNATIONAL tractor, 20 H.P. TITAN tractor, and 20 H.P. MOGUL tractor.

DENS & Co. : 25 H.P. SANDUSKY tractor.

M. R. DUBOIS, of Neuilly : 10 H.P. vineyard tractor. It is 95 cm. wide and can turn in a radius of 1.40 m. There is no differential, but a special device automatically brakes one of the wheels when turning. The engine runs on either petrol or paraffin and has two speeds, one at 500 revs. per minute, producing 6 H.P., is used to drive stationary farm machinery, whilst the other, at 800 revs. is used when running on the road or in the fields. The machine can be run as a locomotive on a track of 60 cm. gauge by fixing a flange on the tyres of the back wheels and placing the fore-carriage by a bogie.

Société FIAT : 25 H.P. FIAT tractor.

MALEVILLE & PIGEON : 22 H.P. FORDSON tractor.

TH. PILTER : 10 H.P. AVERY tractor, and 25 H.P. AUSTIN tractor.

Société RIP : 18 H.P. tractor.

Société de construction et d'entretien de matériel industriel et agricole (S.C.E.M.I.A.) : 14 H.P. E-10 tractor, and 25 H.P.U.-20 tractor.

WALLUT & Co. : MAC CORMICK tractors of 16 and 20 H.P., the same as the 20 H.P. TITAN tractor of the *Cie, internationale des machines agricoles.*

TRACTORS WITH 4 DRIVING WHEELS. — *Ateliers* ATLAS : 18 H.P. model *Picardie* tractor.

Société auxiliaire agricole : 25 H.P. *Agrophile-Pavesi* tractor.

CHAIN-TRACK TRACTOR : — PEUGEOT C. : model 3 tractor ; the shoes of the track are separated from each other by about 6 to 7 centimetres.

The RENAULT Co., exhibited an 18 H.P. tractor that is heavier than previous models and has a wider chain track. The suspension of the frame has been slightly modified, as has the transmission.

MOTOR PLOUGHS. — AMIOT Co.: 30 H.P. motor plough known as *La Gerbe d'Or*.

Société des automobiles DELAHAYE: 30 H.P. *Tournesol* motor plough. The device for lifting the gang has been modified by the introduction of 2 windlasses fixed obliquely to the axis of the machine; the method of attaching the plough bodies to the frame has also been changed.

M. A. RAVAUD: 40 H.P. *Excelsior* motor plough.

FORE-CARRIAGE TRACTORS. — M. L. DUBOIS, of Asnières: 20 H.P. fore-carriage tractor.

Moline Plow & Co.: 18 H.P. fore-carriage tractor.

MOTOR TILLAGE MACHINES. — E. BAUCHE & Co.: 7 H.P. motor tillage machine.

ROTARY CULTIVATORS. — PÉTARD & PRÉJEAN: 8 H.P. rotafy cultivator, fitted with shafts for a horse to draw it.

S.O.M.U.A.: 5 H.P. model A Motoculteur and 35 H.P. model C. Motoculteur.

The general tendency is to simplify self-lift ploughs by placing the bearing of the cam on the hub of the lifting wheel.

MALEVILLE & PIGEON showed an OLIVER plough with lift mechanism consisting of a toothed, eccentric sector that meshes with a lantern pinion keyed on the hub of the wheel, thus lifting the frame.

Messrs PEUGEOT showed a French-made self-lift plough.

It is to be regretted that other French makers who have specialised in the construction of good ploughs do not make self-lift ploughs for tractors, as these have to be imported.

Most of the above tractors run on paraffin, which is cheaper than petrol. Considering the rise in the prices of petrol and paraffin, it is to be hoped the makers will study the use of "poor gas", as this has already been used in motor lorries.

Many of the exhibitors and other makers took part in public demonstrations of power-farming machinery, held from March 10 to 14, at Gally farm, in the Parc de Versailles.

687 - **Tillage with Rotary Machines.** — PIZZARELLI, A., in *L'Industria*, Vol. XXXIII, No. 24, pp. 750-752. Milan, Dec. 31, 1919.

Rotary tillage machines can be made much lighter than ordinary motor ploughs and can thus be used in fields of small size and irregular shape. Consequently, during the last few years, tillage machines have been invented with all kinds of rotary apparatus. The "fraise" type, however, is the most popular and it has been used as a model for several machines known as motocultivators, which differ according to their engine.

The chief objections to this type of tillage are as follows:—

(1) The layer of soil that has furnished the crop is not replaced by that which has remained untouched, a change which takes place in ploughing.

(2) In most soils, a fine tilth should not be produced solely by

machinery, but also by the slow action of natural agencies such as heat, frost, air, etc.

(3) The rotary cultivator does not work the soil as deeply as the plough.

(4) When clay soils are worked with a rotary cultivator they easily crust over after rain, and this is harmful to land that has been seeded.

(5) In damp soil, rotary cultivation leads to the formation of small lumps which are penetrated with difficulty by plant roots.

(6) With rotary cultivation, excessive oxidation of the organic matter is to be feared and, consequently, hyper-nitrification and loss of nitrogen.

On the contrary, however, experience shows that :—

(1) The uniform mixing of the components of the whole arable layer of soil, obtained with the rotary cultivator, should yield better results than the simple substitution of layers brought about by the plough ; it should also distribute the fertilising principles more evenly.

(2) A fine tilth can be produced entirely by mechanical means, i. e., apart from the preponderating help of natural agencies, without harming crop production ; what is required is that the soil should be in the right physical condition: at the moment of sowing, etc. ; in addition, the rotary cultivator incorporates air in the soil in a proportion much greater than that produced by ploughing.

(3) Systematic rotary cultivation of the soil diminishes the need for deep cultivation with the object of conserving rain water, because it acts on the soil capillaries and thus limits the loss of water by evaporation from the deep layers.

(4) Deep cultivation can be carried out by attaching a plough to the tractor in place of the rotary organ.

(5) To avoid the formation of a crust on clay soils, the speed of the rotary organ or the number of hooks must be regulated so that too fine a tilth is not obtained.

(6) As with ploughing, the right time must be chosen for rotary cultivation.

(7) Many cultural practices have the object of favouring the nitrification of the organic matter of the soil ; nitrification could hardly become so active as to lead to the loss of nitrogen because, in most cases, the content of organic nitrogenous matter in the soil is very low ; moreover, if seeding is carried out immediately after rotary cultivation, the seedlings will at once benefit from the nitric nitrogen whose formation has been facilitated by rotary cultivation.

Tests of rotary cultivation, carried out recently in Italy under the most divergent agricultural conditions, have convinced Italian technicians and practical men that the method will rapidly spread. For example, it can replace the shallow cultivation given in summer with the object of destroying capillarity and thus avoiding the evaporation of water that has risen from the deeper layers of the soil.

688 – **French Types of Farm Buildings.** — DABAT, L. Report presented on behalf of the Agricultural Committee, on the collaboration of M.M. VIGNEROT and MAITROT in the publication of the "Modèles-types de Constructions Agricoles" of the Ministry of Agriculture, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXIX, No. 1, pp. 21-24. Paris, Jan.-Feb. 1920. FARM BUILDINGS

The French Ministry of Agriculture has published a work entitled "Modèles-types de Constructions Agricoles" with the object of assisting both farmer and builder in the improvement of rural buildings. The types dealt with result from work carried out in various parts of France by the engineers of the "Corps des Améliorations agricoles" (which has since become the "Corps du Génie rural") who, by their constant contact with the rural populations, have been able accurately to gauge local needs. The types also take into account the data furnished by projects that gained prizes in competitions opened by the "Service des Améliorations agricoles" for architects and builders who have specialised in rural buildings.

In deciding on these model types, recourse has been had continuously both to the most recent and practical information furnished by agricultural science and by hygiene, and to the results acquired by experience. The science and experience have been directed not towards the elaboration of entirely new models, but towards the improvement of regional types studied on the spot with their local characteristics derived from the soil, climate, customs, and economic life of each region.

The result is that these regional model types of agricultural buildings represent a combination of the precepts of treatises on agricultural buildings with a monographic documentation and model projects of a concrete character. They are applicable to the most varied kinds of buildings :— Farms, barns, stables, cattle-sheds, sheepfolds, houses for farmers and of labourers, co-operative works, etc. Each model type includes an introduction explaining and justifying any general or particular arrangements adopted, as well as the economics of the scheme, general and detailed plans, specifications for the work, a detailed estimate of the cost, a memorandum of such regional prices as could be ascertained easily, and a list of charges and conditions for the undertaking.

Farmers who wish to build or restore farm buildings will find in the work in question all information necessary for choosing the arrangements that are best and most suited to their particular region. Builders, architects, contractors, local workmen will be able to find the characteristics of all types of agricultural buildings as well as the basis for any special work they have to carry out.

The work is published in two forms : — (1) The work, text and plates, is bound in a royal-quarto album for each part ; (2) each project separately with large plates. The complete work comprises 4 parts including 80 model types from all the regions of France ; a fifth part will be published later dealing with co-operative factories for dairying, cheese and butter making, distilling, oil extraction and cider making, and with co-operative warehouses, etc. The work was ready for publication, but the advent of the war delayed it so that preparations for publication could only be begun in 1916.

The first two parts, corresponding with the North and East regions of France, have already appeared and will be of great assistance to those who have the heavy task of reconstructing the villages destroyed during the war. A considerable number of these model types of agricultural buildings has been distributed in the devastated agricultural regions by the Ministry for the Liberated Areas, and agricultural societies and other associations interested in the renaissance and development of agriculture in these regions have been supplied with the documents, which are kept by architects and contractors. In this way, the devastated regions in the North and East of France will be the first to benefit from this interesting and original work of the Ministry of Agriculture and, eventually, the other regions will be able to begin the work of improving rural buildings on sound and methodical lines, whilst avoiding the equally bad extremes of superfluous luxury and misguided economy.

The work of preparing and supervising the publication of the model types of farm buildings was confided in 1916 to M. VIGNEROT, a technical official of the Ministry of the Liberated Areas, who edited the whole work and gave homogenity ot the varied contributions from his colleagues. As M. VIGNEROT was sent abroad on a mission in 1918, the work was then placed under the direction of M. MAITROT, who succeeded to M. VIGNEROT'S position in the Ministry. M. MAITROT has mainly been occupied on the diffusion of the model types in the devastated regions, particularly amongst the 1534 co-operative building societies that have been established.

689 – **Royal Prize for a Competition for the Reconstruction of Farms in Belgium.** — Ministère de l'Agriculture. Concours de Reconstruction de fermes, 1920 : Prix du Roi, pp. 1-3. Imprimerie du Roi, Brussels.

By Royal Decree of April 8, 1920 a " Prix du Roi ", worth 25 000 fr., has been established in Belgium for the best example of a group of farm buildings, including the provision of farm machinery and of furniture for the house, which shall be declared by a Royal Jury to satisfy most fully the requirements of hygiene, modern agricultural science and aesthetics, whilst respecting local peculiarities of style. All the farms situated within the area laid down by the Royal Decree of January 23, 1920, and which are completely built by December 31, 1920, can take part in the competition. In case that not more than 5 farms compete, the Ministry of Agriculture is authorised to extend the area to which the competition is limited to the full extent allowed by the Decree. Farms of over 10 hectares are excluded, as are those built by the State or for collective bodies.

The owner of the winning farm can place a tablet above his front door bearing the inscription " Concours de reconstructions de Fermes, 1920. Prix du Roi ". Entries can be sent, in to the secretariat of the jury (M. PAUWELS, Agronome de l'État, at Poperinghe) up to November 30, 1920. Each competitor will receive a copy of the Decree and the conditions of the competition as laid down by the jury and approved of by the Ministry of Agriculture.

AGRICULTURAL INDUSTRIES

690 - **The Chemistry of Concentrated Grape Juices and their Derivatives.** — GARINO CANINA, in the *Rivista di Ampeelografia*, Year I, No. 5, pp. 65-73. Alba-Livorno, March, 1, 1920.

Signor F. MARTINOTTI, director of the Royal Experimental Station for Oenology at Asti described the preparation of grape honey and the machinery for this purpose in Nos. 31 and 33 of the *Giornale vinicolo italiano* of 1917 (1). In Nos. 30 and 32 of the same periodical (1917), Signor E. OTTAVI described the refrigerating plant at the above-mentioned station, a plant which is also used for the manufacture of various grape products. The chief products obtained by concentrating grape juice are :—

Grape syrups. — Red or white, resembling liquid honey in appearance, with a density of about 1.3 at 15°C., and the aroma of the fruit itself. The first concentration is carried out in the cold and results in the separation of about 25 % of the water. The second concentration is carried out under reduced pressure, the water being evaporated at 35-40° C. until the density given above is reached. At this density the syrup keeps well without risk of fermentation. These syrups are used in the preparation of liqueur wines and as beverages.

Grape honey. — This is made by concentrating the juice to a density of 1.38 to 1.44, when first the dextrose and then the levulose crystallise in the form of micro-crystals, which give the product the appearance of solid honey. It can be eaten as a preserve. By adding yolk of egg, of milk, or blood to the syrup and concentrating to the right degree, products can be obtained that Signor MONTI calls ampeloplastine, ampelogalactine, and ampelohaematine, respectively.

Integral extract of marc. — This is prepared by systematically exhausting the residue left after pressing grapes with a slightly sulphurated water at 35-40° C. The liquid thus obtained, with a density about equal to that of the must, is concentrated to the density of the syrups. These extracts contain sugar, colouring matter, acids, and tannin and can be used in blending, to give body and colour to weak musts or wines, or in the preparation of preserves, jams, etc.

The author gives a table showing analyses of grape syrups, integral extracts, concentrated juice, ampeloplastine and ampelogalactine made by various authors, as well as the results of an analysis of honey made from the white grape " Favorita " by th author and which furnished the data reproduced in Table I.

TABLE I. — *Composition of honey from the " Favorita " grape.*

Density at 15° C.	gm. per cent.	1.4025
Extract	» » »	79.86
Reducing sugars	» » »	75.72

(1) See *R.*, Sept., 1917, No. 857. (*Ed.*)

Dextrose	»	»	»	42.47
Levulose	»	»	»	33.05
Total acidity in terms of tartaric acid	»	»	»	0.82
Total tartaric acid	»	»	»	0.54
Malic acid	»	»	»	0.79
Ash	»	»	»	1.10
Total phosphorous	»	»	»	0.085
Organic phosphorus	»	»	»	0.009

In addition the author has determined the degree of proteolysis of concentrated products analysed in 1919 and has obtained the results shown in Table II, from which it appears that the proteolysis varies from 4 % in media very rich in protein to a maximum of 56 % in very poor media, the average value being 25 %.

TABLE II. — *Degree of proteolysis undergone by concentrated grape products analysed in* 1919.

Year of preparation	Products	Percentages of nitrogen				
		total	total soluble	amino-acid.	amidic	amoniacal
1915	Ampeloplastine	2.69	0.740	0.060	0.040	0.049
1915	Ampeloplastine from whey and from the grape-marc extract.	1.75	0.460	0.030	0.023	0.056
1915	Ampelohaematine	4.90	0.196	—	—	—
1915	Ampeloplastine	1.64	0.57	0.052	0.028	0.070
1915	Ampelogalactine	2.24	0.490	0.049	0.016	0.028
1918	Ampelogalactine	1.36	0.308	0.029	0.002	0.008
1918	« Favorita » honey	0.036	0.021	—	—	0.0008

691 - **Disease Ferments in the Vinegar Industry.** — MEZZADROLI G. (Laboratorio tecnico fermentazioni industriali Mezzadroli, Rovigo), in *L'Italia vinicola ed agraria*, Year X, No. 10, pp. 102-104; No. 15, pp. 164-154. Casalmonferrato, March 7, April 11, 1920.

Cases of infection by eel-worms (*Rabditis aceti*) are common in the vinegar industry, but infection by bacteria is rare because there are few bacteria that can withstand even a moderate degree of alcoholisation of wines, which, in addition, are protected against bacterial action by their natural tartaric or tannic acidity. Usually it is not a case of bacterial action in the strict sense so much as of acetic bacteria that have become parasitic or too active. The author records a case like this which occurred in a vinegar works in the " Polesina " ; 2 bacteria were isolated from the liquid in the acetifying vat, one of which was a slow acetifier, and the other acetophagous. The latter causes a considerable rise in temperature and, instead of stopping the action at the acetic acid stage, prolongs to the carbon dioxide and water stage. These two bacteria are quite distinct from true acetic ferments, not only on account of their chemical behaviour but also of the pigmentation produced in culture media. The cause o

these infections lies either in the bad quality of the wianes available for conversion into vinegar, or in the acetification of fruit wines that still contain considerable amounts of suspended organic matter and are liable to be invaded by disease-producing organisms.

The only remedy is to pasteurise wines that are to be acetified, whilst vats that are already infected by parasitic, inactive, or acetophagous organisms should be steamed or treated with sulphur dioxide followed by washing with pure water; after this the vat is charged with good vinegar and with cultures of acetic ferments that have been selected and tested.

592 – **The Enzymes in Germinated Barley.** — MAESTRINI, D., in the *Atti della Reale Accademia dei Lincei, Seris Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXVIII, Part 12, pp. 509-511. Rome, Dec., 1919.

The author has investigated the various enzymes present in germinated barley and has found amylase, protease, lipase, invertase, catalase, and oxydase to be present; he found no maltase, lactase or "labferment".

593 – **Milling and Baking Value of Sprouted Wheat.** — BIRCHARD, F. J. (Chemist, Federal Grain Research Laboratory), in *The Agricultural Gazette of Canada*, Vol. 6, No. 12, pp. 1026-1027. Ottawa, Dec. 1919.

The value of flour made from sprouted wheat is being studied at the Federal Grain Research Laboratory, Department of trade and Commerce Winnipeg. The samples examined had mostly been classed as No grade, No. 3, Northern, Rejected, tough or damp. The quantity and development of the germs in the different samples showed great variations, and as there were considerable differences in the characters of the original wheats before sprouting, it was necessary to be very cautions in drawing conclusions from the tests. The general conclusions given below, however, were deduced from the completed series of tests.

As far as regards the milling value of wheat, sprouting can be considered as a disadvantage as the scouring loss is increased and the yield of flour decreased, the loss generally increasing with the quantity and degree of sprouting.

As regards the baking value, the most striking character is the greatly increased volume of the bread obtained by using ordinary methods This was observed in every case when the original wheats were hard, even when sprouting was very advanced. The large increase in volume, however, was found to have a very bad effect on the texture of the loaves; when the baking methods were changed so as to obtain a smaller loaf, there was a corresponding improvement in texture. The colour of bread made from sprouted wheat that had simply been milled was more or less bad according as the proportion of sprouting was greater or less; however, when wheat flour classed Northern 1, 2 and 3 was mixed with different percentages (up to 25 %) of flour from sprouted wheat containing a large proportion of hard wheat, the colour and texture was always improved, but this improvement could not be obtained when the original wheat was of inferior quality. In each case, the absorption was slightly less. The general appearance and shape of

the loaves made from mixed flour were in every way excellent, and the improvement obtained by mixing flour from sprouted wheat with flour from normal wheat was very marked in respect of these characters.

The best method, then, of utilising flour from sprouted wheat is to mix it with hard wheat flour. The sole use of flour from sprouted wheat (No Grade, Rejected, No. 3) Northern, is not advisable, but it may be very beneficial to mix it with hard wheat flour, even in relatively large proportions. For example, it was found that 20 % or more of flour made from samples of germinated wheat can be mixed with flour of the Northern No. 1 wheat, and that the mixture produces a loaf equal in baking quality to that made from Northern No. 1 wheat alone. When the original sprouted wheat is of high quality, this percentage can be considerably increased.

The baking value of the Rejected (because of the sprouts) wheat No. 3 Northern, cannot be easily decided, because of the wide variations in the quality of the original wheat as well as in the degree and quantity of sprouting. However, when the original wheat was of poor quality and contained a large percentage of starchy kernels, the baking quality was bad ; but, on the other hand, hard wheat could carry a greater percentage of sprouted kernels without its baking value deteriorating to the same extent. In this case, only when the percentage was very large and sprouting far advanced did defects in texture and colour become evident.

694 – **The Extraction and Utilisation of the Textile Fibres of Mulberry Bark.** — Report by M. J. DANTZER, on behalf of the " Comité des arts méchaniques ", in the *Bulletin de la Société pour l'encouragement de l'Industrie nationale*, Year 119, Vol. 132, N. 1, Paris, Jan.-Feb., 1920.

The pre-war requirements of France in vegetable textile fibres were considerable, the chief being as follows :—

Carded, long-staple flax	about 51 000 000 kg.
Flax tow	» 50 000 000 »
Carded long-staple hemp	» 23 000 000 »
Hemp tow	» 14 000 000 »
Jute	» 110 000 000 »
Raw cotton	» 275 000 000 »

These materials, which played an important part in the economic activity of the country, were almost entirely of foreign origin and were never lacking. To day, the conditions have changed, the world's production becomes ever more scarce, and certain French industries that are now painfully reconstituting themselves are finding the greatest difficulty in obtaining even part of their requirements. The linen industry particularly, which depended on Russia for 90 % of its requirements, faces the future with the greatest anxiety and searches for some way out of the critical situation.

Starting from this standpoint, M. POL PAXION (8, Boulevard du 14 Juillet, Troyes), had the idea of reexamining the question of utilising the mulberry bark fibres known as " vegetable silk ". It has long been

known that mulberry bark, particularly that of young branches 1 or 2 years old, contains strong, supple, silky fibres of an average length of 25 to 35 mm. and even 40 mm. The extraction of these fibres had, however, not been put on such a practical and economic basis as would make it susceptible to industrial application (1).

Practically all the suggested methods, based on the use of caustic soda, soap, chloride of lime, etc., certainly bring about degumming, but, judging from the patents that have been filed, the greatest difficulty is to isolate the fibres after degumming so that they can be spun. This means that, as soon as the gum is removed, the chemical action must be stopped and prevented from going further. But if degumming is not carried far enough, the fibres stick together in straps when they are dried and yield a hard material that is refractory to spinning. If, however, the degumming is carried too far, the fibres are attacked, becoming too short and of no use for spinning.

M. Poi. Paxion who has had a long experience of spinning, took up the work where his predessors left off and, in collaboration with M. J. Dufour, discovered a process for extracting mulberry bark fibre after numerous experiments. In this process, after having freed the raw material by decortication and treatment to make it supple, the raw material is degummed in a warm bath of carbonate of soda, and then washed in a bath of cold water containing some neutral powder such as talc in suspension. M. Paxion found that the fibres then are easily separated and, after drying and beating, spin quite well, provided that they are garnetted before carding.

The inventor claims that the decorticating machine will deal with a branch 2 metres long in one second ; the machine is about 30 cm.wide, 60 cm. long, 50 cm. high, and has a capacity of about 2 metric tons of wood in 10 hours with a consumption of under 2 H.P. It is very simple and consists essentially in (1) a pair of feed cylinders, (2) a pair of dividing rolls, (3) a mobile double board bearing decorticating knives, and (4) a pair of extracting cylinders.

The small samples of the raw materials degummed and treated with talc, as well the strips and pieces of tape submitted to the author of the report by M. Paxion in illustration of his process represented laboratory tests rather than industrial results, but they sufficed to verify the claims made by the inventor, though they did not warrant the conclusions he would have wished. The author of the report will be glad to see whole bobbins, ribbons, etc., as a proof of the applicability of the invention, which is apparently quite sound and worthy of attracting attention in the industrial world, especially as it renders available a new raw material abundant supplies of which are available in silk-producing countries. In any case, the author believes that M. Paxion's process, though not yet capable of industrial application, can be recommended with confidence.

(1) See *R.*, Sept., 1918, No. 1040. (*Ed.*)

695 - **Tomato Silo and Moulds on Concentrated Tomato Juice.** — BERTARELLI, E. in *La Riforma agraria, Rivista mensile illustrata delle Organizzazioni agrarie parmesani* (1), Year 1, No. 1, pp. 18-19. Parma, Jan., 1920.

In considering the industrial preparation of preserved tomato juice, the author brings forward several points that require experimental investigation. The critical stage of the modern industry is the preservation of the whole fruit. The silos consist of refrigerated tanks with brick bottoms (which may be painted), usually rectangular in shape and sloping towards the median axis where is placed a small canal (with the endless screw that conveys the juice and tomatoes) with walls part brick part wood. The tomatoes are pushed towards the canal by their own weight and by pressure applied by sticks, boards, etc.

The author demonstrates that the silos should have a smaller surface, a greater height, a circular section, walls that are air-tight, and also shows that not whole tomatoes, but those that have been through the evaporator, should be put in, so as to avoid the enclosure of air in the mass, which should be fluid and even in texture. Data for the dimensions of cylindrical recipients, the limits of cooling (never below + 5° or + 4° C.), methods of refrigeration (systems of axial batteries such as are used for beer), are all points requiring discussion by competent persons and, in any case, they will have to be tested.

AGRICULTURAL PRODUCTS; PRESERVING, PACKING, TRANSPORT, TRADE

696 - **The Storage of Pears.** — See No. 656 of this *Review*.

697 - **Canadian Railways and Agricultural Development.** — MAC INTOSH, G. E., in *The Agricultural Gazette of Canada*, Vol. 6, No. 12, pp. 1032-1033. Ottawa, Dec.; 1919.

The chief problems now before Canadian producers of fruit and vegetables consist in, *firstly*, the improvement of the quality of their products, *secondly*, the creation of a greater demand for them and, *thirdly*, the perfection of an economically good system of distribution. The first two points can be realised by education work carried out on a wide basis, but the main point is that of distribution. A satisfactory system of distribution can only be obtained by the closest co-operation between the producers and the railway and express companies.

It is generally admitted that, in Canada, where perishable food products have to be transported under severe climatic conditions, the question of transport requires very special attention. Practically every branch of agriculture, especially fruit, vegetables, poultry, dairy and live stock interests are essentially dependent on transport facilities, and agriculture, including live stock, furnishes about 24 % of the total railway freight tonnage. In 1919, the Canadian railways carried over 15 000 car loads of apples alone.

Interesting statistics have been published in the United States showing

(1) This new periodical is published by the agricultural organizations in the region of Parma, organizations which are amongst the most advanced in Italy, with the object of dealing with all technical, economic and social questions affecting agriculture and thus helping towards improvement. (*Ed.*)

what the railways have done to help the agricultural districts that they have served. Before the war, one company had been organising agricultural societies for 8 years in the districts through which it ran, and to such effect that now there is hardly a village of 300 inhabitants in its area that has no active agricultural society dealing with the development of all kinds of crops. In 1915, that company carried 3500 cars of fruit and vegetables in 90 days, as compared with an insignificant number a few years previously, the progress being due to the work of organisation. Another company that had taken similar steps stated that the quantity of fruit and garden produce had increased by over 100 % in 5 years. Another company, thanks to this propaganda, now carries hundreds of cars of fruit and vegetables where it previously carried hardly any. One company publishes a monthly magazine and distributes it to its clients, whilst another has opened a locality especially suited to strawberry growing, and about 8 acres has been planted to strawberries in the first year ; this undertaking developed to such an extent that, in 1918, the railway company carried some 600 wagons in 1918. Eight companies have established experimental and demonstration farms.

The Canadian railways have the future of agriculture in Canada very much at heart. They have made experiments, organised large numbers of agricultural shows, and provided improved services when any reasonable requests have been made. But in spite of the progress made, much united effort is required to achieve still greater development.

The transport service of the Fruit Branch of the Canadian Ministry of Agriculture has the intention of establishing very intimate relations between all the interested parties (producers, carriers, consignees) and to receive complaints from the consignors, and do all that it can to improve the transport of fruit and vegetables as much as possible. It is obvious that a railway company wishing to be of as much service as possible to the producers of fruit and vegetables living near its line, must not limit itself to the construction of tracks, and the provision of trains and transport for goods, but it should take an effective interest, whether direct or indirect, in the work of the producers. The best way to do this is to deal with a central representative of the producers, and, in fact, at the producers' request a special study has been made of local questions of transport in all the provinces, in all the districts or at all the shipping points.

The question of safe, rapid and effective transport is to-day of more interest to the country than the question of the low cost of transport. This perhaps applies more to fruit and vegetables than to manufactured goods. The day is not remote when the railway time-table will be arranged for the transport of crops rather than of passengers. Even now, there is a low charge for collecting, the privileges of mixing have been extended, joint commodity rates have been established, good minimum rates are provided, preference is given to producers in allotting wagons, and, in many other matters, every help is given to the producer to enable him to dispose of his products.

The fact that, in Canada, the annual production of fruit and vegetables is valued at $50 000 000, and requires 500 000 cars or their equivalent for transport, and that the value of the fruit production will probably be doubled in 10 years, indicates that the transport and distribution of this immense crop of perishable goods constitute one of most serious problems that Canadian producers have to face. It is estimated that Canadian railway cars, at an average distance of carriage of 216 miles per car will be used 4 times in an ordinary season to transport the fruit crop. This illustrates the intimate relationship that exists between transport and agriculture, the fruit and vegetable industries particularly, and shows that the interests of all the branches of agriculture and of the railways are identical.

DISEASES OF PLANTS

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

698 – **The Mottling Disease of Sugar Cane at Porto Rico** (1). — STEVENSON, J. A., in the *Journal of the Department of Agriculture of Porto Rico*, Vol. III, No. 5, pp. 3-76, figs. 7, plates 3. San Juan, P. R., 1919.

A serious epidemic disease of sugar cane has for some years been, and is still, spreading in Porto Rico. Of the different names proposed for the disease, the author prefers that of "mottling disease".

The disease appeared at first in the north-western area of the island (Arecibo-Aguadilla) and has since spread rapidly towards the east, so that only a part of the eastern and south-eastern coastal regions still remain free from attack; the spread of the disease still continues. Elevated ground, generally speaking, is usually affected most seriously.

In 1918, a loss of $2 500 000 was caused by the disease which has the main effect of lowering the crop or the quantity of sugar in the cane juice There are often difficulties in extracting the juice from infected canes.

Mottling disease has been observed on several varieties at San Domingo, where, however, the infection was not epidemic in character. An infected region at St. Croix (Lesser Antilles) has been reported. The white variety ("Blanca", or "Otaheite") was the first to be seriously attacked at Porto Rico, but, later, the striped ("Rayada") and other native varieties were attacked. The numerous foreign varieties that have been introduced into the island vary very greatly in their resistance to the disease, as some are very subject to it, whilst others are apparently resistant.

The disease is characterised at first by the mottling of the leaves; in the advanced stages the whole tuft of canes wilts and grey depressed lesions appear on them. The appearance of the marbling varies greatly according to variety attacked. The disease approximately follows a course of 3 years, becoming more serious at each successive production of shoots, and finally causing the death of the clumps of cane. So far, the disease has not been observed on other plants.

Observations made in the plantations confirm the opinion that the

(1) Cf. *R.*, May, 1919, No. 655 and *R.*, June, 1919, No. 785. (*Ed.*)

nature of the soil, the number of years for which the soil has been cultivated, the method of preparing the soil, the drainage and other cultural factors have no direct connection with the appearance of the disease. Observations carried out in the field and in the greenhouse as well as experimental work show that fertilisers, liming, the treatment of the cuttings, the burning of the cane residues, the dampness of the soil, etc., have no direct influence.

The disease has not yet been transmitted artificially. Chemical examination of the juice has not revealed the presence of an abnormal proportion of glucose or of any constant difference between the juice from normal or diseased canes. The bacteria and fungi found on the leaves and stems cannot be considered as causal agents of the disease. The cankers observed on the cane are due to the general weakening of the plant and are not produced *ab origine* by fungi, though these may attack the plant when weakened by the disease.

The experimental planting of stems with partially mottled leaves has only shown that the infection is present throughout the diseased plant. The disease is transmitted by diseased cuttings used in new plantations, and probably also by other means that are not yet ascertained It does not persist in the soil and, consequently, infection does not take place through the root system ; this suggests that insects may be concerned in the propagation of the disease.

The disease is considered to be an infectious chlorosis due to a virus or an ultra-microscopic organism. The theory of the degeneration of the cane has now been completely abandoned.

LYON considers that the yellow stripe disease of sugar cane in Java and Hawai is the same as this one. In fact, there are many points of similarity, but the author thinks that LYON'S opinion is not acceptable, at any rate for the present. Sereh is a disease of sugar cane which has occasionally assumed an infectious character in Java and, though similar to mottling in certain respects, it is, however, quite distinct from it. It is considered that the causes of the two diseases are of the same nature.

There are certain diseases or anomalies of the sugar cane which have been or can be easily confused with mottling. Degeneration of the cane is due to the uninterrupted cultivation of the same variety over too long a period, to the lack or shortage of fertilisers, to unfavourable atmospheric conditions, or to other factors of a non-parasitic nature. It is distinct from the yellowing of the leaves and the withering of the clumps of cane.

There is also a disease of the roots caused by parasitic fungi which has not been definitely differentiated. Chlorosis is a yellowing or whitening of the leaves of whole tufts over limited areas due to the fact that the excess of lime in the soil prevents the plant from assimilating sufficient iron. Yellow spotting is characterised by the presence of spots on the leaves that resemble those of mottling, but are of a more intense yellow colour ; it is due to the lack of cultivation or to drought.

Long white stripes are liable to appear on the leaves of certain varieties of sugar cane and, in greenhouses, mites may cause the appearance

of stripes on the leaves that are almost indistinguishable from those of mottling. The grey pustules that appear on the stems are probably due to sunstroke or to the presence of fungi.

A very serious epidemic disease of sugar cane appeared in Porto Rico in 1872-80 and was studied by a Commission, without, however, its cause being ascertained. In certain respects it resembled mottling, but could not be said to be the same disease. It was controlled by natural agencies and by the use of resistant varieties. A late stage of the disease was found to be due to the attacks of insect larvae. Again, mottling has no connection with the rind disease (*Melanconium Sacchari*) or with the gumming disease (*Bacterium vascularum*).

The control of mottling is based on the use of healthy cuttings and the elimination of diseased canes either by ploughing in seriously diseased crops or by removing diseased tufts. In addition, active co-operation of all the cane growers is necessary. The most resistant varieties must be used and susceptible ones eliminated, whilst research should be continued with the object of finding varieties with greater resistance or, if possible, complete immunity.

699 – **The Behaviour of Frozen Vines, in Upper Italy.** — See No. 664 of this *Review*.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

DISEASES DUE TO FUNGI ETC., OF VARIOUS CROPS

700 – ***Bacillus Lathyri*** **(?) injurious to the Tomato in England.** — PAINE, S. G. and BOWLEY, W. F., in *The Journal of the Ministry of Agriculture*, Vol. XXVI, No. 10, pp. 998-1000. London, Jan., 1920;

The stripe disease of the tomato is common in English tomato beds and sometimes causes considerable loss. During the first half of 1919, about 25 % of the crop gathered in the greenhouses of the Experiment Station at Cheshunt (Herts) was so seriously affected that it could only be sold as refuse, and the whole crop was lost in greenhouses where the disease was very severe. In 1921, some plants affected, with stripe disease were sent to Kew from two localities where the disease was rife. Although the disease mainly appears in forcing houses, it has been observed in a garden where the plant were grown in a part with a southern exposure and protected by a high wall. A disease thought to be identical with stripe disease has been recorded from the United States and Canada and had once been observed near Toronto on tomatoes grown in the open field, 1 % of the plants being attacked.

The chief symptoms of the disease consist of brown stripes on the stem, brown sunken spots on the friut, and wrinkled brown areas on the leaves. The stripes on the stem may be scattered at intervals or may be so numerous as to cover the stem completely in severe cases. In some cases these are replaced by small brown spots and in others there are long furrows which sometimes extend from the base of a leaf to the nearest node below.

The disease frequently appears in seed beds, rapidly destroying the young plants and making a fresh sowing necessary.

The plants are usually attacked in their subterranean parts, the infecting micro-organism penetrating the bark of the roots and stem through wounds made by sucking insects. The aerial portions of the plants are also subject to infection through wounds produced by sucking insects, whilst an infected pruning knife may inoculate the plant with the parasite. The causal agent of the disease is an organism closely related to, if not identical with, the *Bacillus Lathyri* of Manns and Taubenhaus.

The Kondine Red and Comet varieties are much more susceptible to the disease than the Ailsa Craig variety when grown in the same ground and under the same conditions. Varieties which grow rapidly and have soft tissues in their early stages are usually more subject to infection.

Excess of nitrogen and lack of potash in the fertiliser employed, tend to reduce the resistance of the plant to the parasite, but the effect of excess of nitrogen can be largely compensated for by giving a larger quantity of potash.

Seeds from fruit gathered on infected areas should not be used for sowing. A variety resistant to the disease is required. Wherever the disease has appeared, the soil should be sterilised by means of heat. In applying fertilisers, an excess of nitrogen and a lack of potash should be avoided.

Special attention should be given to pruning wherever the disease has occurred. Once an infected plant has been pruned, the knife should be sterilised by rubbing it with rag soaked in 2 % lysol or any similar disinfectant, particularly when passing on to prune a healthy plant. The prunings from an infected plant should be carefully collected and burnt.

In cases where the infection has appeared on the upper part of a plant, the suppression of the infected stem and the development of a lateral shoot often suffice to re-establish completely the health of the plant, which then produces a healthy product.

When young plants are seriously affected, the further extension of the disease may be stopped by modifying the conditions of heating and humidity in such a way as to favour more vigorous growth.

701 – ***Phytophthora* sp., injurious to *Papaver nudicaule* in Victoria, Australia.** — BRITTLEBANK C. C., in *The Journal of the Department of Agriculture, Victoria, Australia*, Vol. XVII, Part. II, p. 700. Melbourne, 1919.

During recent years, *Papaver nudicaule* L. has been subject to a disease which, in certain cases, killed 80 or 90 % of the specimens of this plant in a garden. Usually, the period of attack or, rather, the moment when the disease first becomes perceptible, is just when or just before the buds form ; but the plants are subject to attack at all stages of growth.

Diseased specimens at first appear slightly wilted and then the basal portion of the leaves and the floral peduncles become brown and rot. When the attack is slight, only a few leaves are attacked, and as these die they give the plant an untidy appearance. Many of the plants that are slightly attacked bear leaves slightly smaller than normal ones, so

that the plant becomes close and bushy. Such plants rarely flower and the dense foliage retains the damp and this in turn favours the development of the disease.

The cause of the disease was unknown till, in the beginning of 1919, a species of *Phytophthora* was isolated from diseased plants.

The disease can be completely eliminated by spraying with copper-soda wash.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERAL

702 - **On the Presence in France of the Injurious Ant *Iridomyrmex humilis*** (1). — MARCHAL, P. and POUTIERS, N., VIDAL, HALLER, BOUVIERS, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VI, No. 12. (March 24, 1920), pp. 315-323, fig. Paris, 1920.

MM. P. MARCHAL and R. POUTIERS draw attention to the presence, in the south of France, of the ant *Iridomyrmex humilis* Mayr., known as the Argentine ant, which has become famous in various parts of the world for the damage it does to human habitations, rabbit-hutches, hen-houses, hives and, directly or indirectly, to crops as well.

The first record of the insect in France came from Tamaris, near Toulon, where it had probably been brought on plants from South America and its colonies now extend over an area of at least 10 hectares. In the Cannes district a still larger centre has been discovered, extending over some 150 hectares from Croix-des-Gardes to Bocca, and apparently introduced in a similar way to the preceding one. There is no doubt that these centres will extend from year to year through the transport of plants from an infected to a healthy region, and it is probable that, between Toulon and Cannes as well as other points on the coast, the Argentine ant has already established numerous colonies. Preparatory to a more complete study of the insect, the authors give a summary description of the insect, its habits, and the chief methods of control used in other countries, especially the United States, to prevent its spread.

MM. VIDAL, HALLER, and BOUVIER contribute the following supplementary observations :—

M. VIDAL states that a very simple method is used in the Hyères region for getting rid of ants, which consists in soaking a straw in water, than rubbing it in crystallised mercuric chloride and inserting into the ant heap. In a few moments, the ants come out and, under the influence of the poison, fight and eat each other. This remedy would be probably quite as effective against the Argentine ant.

M. MARCHAL says that in the United States, particularly in New Orleans, strips soaked in mercuric chloride are sold for use against the insect.

M. HALLER quotes BERTHELOT who states, in one of his works, that, wishing to prevent ants from entering into a laboratory, he surrounded it with a small trench filled wih tar and this the ants never crossed.

(1) See *R.*, June, 1911, No. 1968 and *R.*, Sept., 1913, No. 1114. (*Ed.*)

According to M. BOUVIER, the most important thing is to destroy the ant heap containing the queens, the best way to do this being the method cited by M. Marchal, which consists in making the workers carry into the ant heap some quick-acting, toxic substance.

703 – **The Influence of Rain on the Diffusion of *Tomaspis saccharina* a Weevil attacking Sugar Cane in Trinidad** (1). — WILLIAMS, C. B., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVIII, Part. 3, pp. 153-167, figs. II. Port-of-Spain, 1919.

The author has shown that the alternation of wet and dry periods during the growth of the sugar cane constitutes an important factor in the determination of the preponderance of the disease known as frog hopper blight and due to the cercopid *Tomaspis saccharina* Dist. A long dry period followed by abnormally abundant rain in June or July is often correlated with a wide diffusion of the blight.

However, the most important climatic condition appears to be the nature of the " Indian summer ", or dry season of varying length which comes on almost every year in August, September, and October. An intense Indian summer constitutes a general condition either of the localities attacked by blight or of years of wide diffusion of the disease in any one locality.

The intensity of the blight can be attenuated, independently of its prime cause, by putting the field of sugar canes in such conditions that the effects of excessive damp or drought will be felt less. Much can be done towards this end by improving the drainage.

MEANS OF PREVENTION AND CONTROL

704 – **Observations on the Food of the Common Nightjar *(Caprimulgus europaeus)* in England.** — COLLINGE, W. E., in *The Journal of the Ministry of Agriculture*, Vol. XXVI, No. 10, pp. 992-995, fig. 1. London, 1920.

The nightjar (*Caprimulgus europeaus* L.) usually arrives in England from its African winter quarters about the first or second week in May and generally returns about the middle of September.

Like other nocturnal or twilight animals, this bird is feared and has given rise to many superstitions. During the last twenty years its numbers have decreased to such an extent that it no longer returns to localities where it was once common. Nevertheless, there are few birds so useful as this to agriculture and fruit growing for the control of injurious insects.

Although most ornithologists are agreed as to the nature of the food of the nightjar, no exact data on the subject are available. To fill the gap, the author has examined the stomach contents of nightjars from seven widely separated localities. On an average, he obtained for his investigations two nightjars each month from May to September. The whole food found in the stomachs of the 62 birds examined consisted of animal matter which was entirely composed of insects. The following species of insect were found :— *Hepialus humuli, H. lupulinus, Cheimatobia brumata, Mamestra brassicae, Agrotis segetum, A. exclamation,*

(1) See *R.*, April, 1917, No. 395 ; *R.*, Aug., 1918, No. 939 ; *R.*, May, 1919, No. 671. (*Ed.*)

Triphaena pronuba, Melolontha vulgaris, Phyllopertha horticola, Rhizotrogus solstitialis, Geotrupes sp., *Tipula oleracea*, and remains of other lepidoptera, coleoptera and diptera.

Of the total food consumed between May and September, 88 % was composed of insects injurious to agriculture and 12 % of insects of a neutral character. The injurious insects all belonged to widely distributed common species and included the greatest pests with which the farmer and fruit grower have to contend.

It is very difficult to calculate the actual number of insects destroyed by the nightjar when flying, chiefly between sunset and sunrise, but it will suffice to say that the stomach of a bird killed on an early morning in July contained the remains of 15 specimens of *Rhizotrogus solstitialis*, 97 specimens of *Hepialus lupulinus*, 40 specimens of *Agrotis segetum*, and 8 adults of *Tryphaena pronuba* ; another nightjar, killed in August at about 10 p. m., had the remains of 163 specimens and fragments of numerous lepidoptera and coleoptera in its stomach.

On account of its great utility, the nightjar and its eggs should be closely protected, by legislative measures if necessary, for the whole period during which it lives in England.

705 - **On the Action of Chloropicrin on the Parasites of Wheat and on Rats** (1). — PIUTTI, A., in the *Comptes rendus des Séances de l'Académie des Sciences*, First Half-year, 1920, Vol. CLXX, No. 14 (April 6, 1920), pp. 854-856. Paris, 1920.

The author states that recent experiments by M. G. BERTRAND and his collaborators (1919-20) on the toxic action of chloropicrin on various animals clearly confirm the experimental results obtained by himself and M. L. BERNARDINI and published in 1917 and 1918.

Regarding the action of chloropicrin on the parasites of wheat (*Calandra granaria, Tenebrioides mauritanicus, Laemophlaeus ferrugineus, Sitotroga cerealella, Tinea granella, Plodia americana*), it should be observed that the numerous experiments by MM. PIUTTI and BERNARDINI, which were always conducted with wheat that was very damaged, were carried out at first on a small scale under bell-jars, and then on a large scale on tons of wheat stored in a corn mill. All these experiments clearly showed that if chloropicrin acts on wheat for about a week at a strength of 20 cc. per cubic metre of space (whether occupied by wheat or not) at a temperature of about 15-20°C., excellent results are obtained as far as the death of the parasites is concerned. Under these conditions, the parasiticidal action of chloropicrin is greater than that of carbon bisulphide, which, if the same results are to be obtained, must be used in far greater quantities and has, moreover, well known disadvantages (inflammability). Other things being equal, it has been shown that a higher temperature greatly assists the parasiticidal action of chloropicrin, as this becomes more volatile.

(1) See *R.*, **July-Sept.**, 1919, Nos. 1049-1050 ; *R.*, Jan., 1920, Nos. 6 and 148 ; *R.*, Feb., 1920, No. 274 ; *R.*, **March**, 1920, Nos. 374 and 378 ; *R.*, May , 1920, No. 595. (*Ed.*)

Flour and bread made from wheat treated with chloropicrin was quite harmless and had lost none of its food value. It is remarkable, however, that wheat treated with chloropicrin loses about 30 % of its germinating capacity. In M. BERTRAND'S experiments, the amount of liquid used per cubic metre was about 10 times that employed by M. PIUTTI and BERNARDINI; in this case, it can be foreseen (apart from the disadvantages of such high concentrations from the practical point of view) that the germinating capacity of the grain would undergo too violent a destructive action.

Experiments carried out by MM. PIUTTI and BERNARDINI in 1917, with the object of testing the use of chloropicrin for freeing ships from rats, were at first made in the laboratory in suitable chambers and afterwards in ships' holds of a capacity of 800 and 1075 cu. m., respectivelly. When the chloropicrin, placed in a tin on deck was allowed to fall drop by drop into canvas tube containing cotton-wool, all the rats that had been placed at varying heights in the hold were dead in two and a half hours. These results were obtained by using only 1.5 kg. of chloropicrin, i.e., 900 cc. of liquid. Experiments by M. BERTRAND, with much higher concentrations than those employed by MM. PIUTTI and BERNARDINI, confirm the results of these authors and also show that the rat fleas were killed as well as the rats, a result which is of vital importance as regards the transmission of disease.

INSECTS ETC. INJURIOUS TO VARIOUS CROPS

706 - ***Corcyra cephalonica*, a Microlepidopteron Injurious to Cacao Beans and other Stored Vegetable Products in the United States.** CHITTENDEN, F. H., in the *U. S. Dept. of Agriculture, Bulletin* 783, pp. 1-15, figs. 2, plates 5. Washington, D. C., 1919.

Amongst the insects injurious to stored vegetable products that have been observed recently in the United States, the tiny larva of the microlepidopteron *Corcyra cephalonica* Saint. (fam. *Pyralidae*) has attracted attention on account of the damage it does. The insect has not previously been recorded as of any great importance and has not even a common or English name; but, as it has been recorded as particularly injurious to stored rice, it can be called the "rice moth".

The damage caused by the insect in a chocolate works in western Pennsylvania was only known in October, 1911 and, a year after, similar damage was caused in another works in the same State, but the species was not definitely established until 1916.

The first correspondent of the U. S. Bureau of Entomology to record the insect, wrote that imported beans of *Theobroma Cacao* were subject to attack by the larva of the insect. The moth apparently lays its eggs on the brans, which are often stored for several months in the country of origin. During this period of storage, several generations of larvae hatch out and destroy or render unsaleable large quantitie of cacao beans.

Before this, the Bureau of Entomology had received the adult, chrysalids and larvae of *C. cephalonica* from Porto Rico and California, where it was attacking stored rice.

The origin of the insect is unknown; it has been introduced into nu-

nerous places on other continents, but it cannot be said to be truly cosmopolitan. It is common in England, where it has been introduced on rice, mainly from India, and also on dried fruit.

The habit of feeding of cacao beans has been acquired and the insect obviously tends to be omnivorous, as it lives in rice, dried fruits, various cacao products (shells, cocoa powder, chocolate containing sugar or not), and sesame seeds and cake. However, it shows no preference for any one of these food substances.

The entire life cycle on the insect is not known, but apparently it breeds throughout the year. In the United States the attacks of the pest diminish from time to time, although they assume fresh vigour on the arrival of new cargos of cacao beans from Central or South America.

The insect covers the surface of the substances on which it feeds (rice, cacao, etc.), with silky threads and, in this respect, it resembles *Ephestia cautella* Walk, and related species as well as *Plodia interpunctella* Hbn.

Stores into which the insect has penetrated should be carefully and thoroughly cleaned. All the corners and nicks where the moth could hide should be vigourously swept and the dust, etc., should be burnt. The walls and floors should be washed with a solution of creosote or of kitchen salt. The same attention should be devoted to the machinery, etc. Sacks which contain or have contained food products infested by the insect as well as the machinery, etc., should be disinfected, either by heat or by fumigating with hydrocyanic acid or carbon bisulphide.

707 – ***Leptops hopei*, a Beetle injurious to the Apple Tree in New South Wales, Australia.** — FROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol. XXXI, Part. 1, pp. 56-60, fig. 1, plate 1. Sydney, 1920.

In an orchard in the Epping district of New South Wales, a large number of apple trees which had been uprooted on account of their unhealthy condition were found to be seriously damaged by the larvae of *Leptops hopei*. The larvae feed on the larger roots, gnawing the bark and the surface of the wood ; attacked roots die. The sole record of *L. hopei* as a root parasite in New South Wales dates back several years and relates to an orchard at Mount Pleasant, West Maitland, where, however, the insect has not been seen for several years since then.

The adult insect as well as other weevils have been found on several occasions causing considerable damage to the opening buds of the vine and other fruit trees. In 1918, the author recorded damage caused by adults of *L. hopei* to a vineyard near Glenfield, where thousands of the beetle could be taken by hand and destroyed when they were feeding at night on vine buds just about to open.

The eggs are laid on one part of the leaf blade and covered with the other part, which is fastened down with a sticky secretion. The larvae descend the trunk and enter the soil, where they begin to attack the roots. The adults emerge from the soil from the beginning of September to the end of November. If they can be prevented from reaching the leaves on

taken when they are ascending the trunk, the roots can be saved from the attack of further larvae. A simple method for doing this consists in fixing round the trunk, about 30 cm. above the soil, an inverted funnel made of metal or coarse oiled paper, and collecting and destroying each week, during the period when the perfect insects appear, all those hidden under the obstacle formed by the funnel. To catch the larvae that descend the tree, a band of paper covered with some sticky material should be fastened around the trunk.

Lead arsenate sprays applied to the topmost foliage will kill any adult beetles that have reached that part of the tree.

708 - **A Dipteron Injurious to the Almond Tree in Apulia, Italy.** - VIVARELLI, L., in *La Propaganda Agricola*, Series II, Year XII. No. 3, pp. 26-27. Bari, Feb. 13, 1920.

In February, 1920, a heavy fall of floral buds and flowers of the almond tree was observed, especially in the commune of Andria (province of Bari); there was no reason for attributing this fall to unfavourable weather.

The author examined numerous flowers that were opened or about to open, collected from various localities, and found that, in every case, tiny larvae of a dipteron belonging to the family *Cecidomyidae* were present round the base of the ovary.

As far as the author knows, a cecidomyid that is a specific parasite of the almond tree has not yet been studied or described, and even the oldest farmers in the district do not remember such an abundant fall of flowers caused by larvae similar to those recently observed. The author considers that it is a question of a chance parasite which has chosen the almond flowers as its host. As a rule, cecidomyid flies begin their cycle of active life in March, beginning it in southern Italy during the first few days of the month if the weather is favourable. In 1920, the season was in no way winterly up to the end of January and, according to the author, the warm days and a little occasional rain hastened the hatching out of one or more species of cecidomyid that are parasites of other plants which normally flower after the almond tree (pear, apple, cherry, plum, and apricot); as the fertilised females only found the almond in flower, they oviposited on it.

At the present stage all that can be recommended in the way of control is to gather the flowers as they fall and burn them, thus giving the larvae no time to enter the soil and pupate.

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ALFREDO RUGGERI, *gerente responsabile*.

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

DÉVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

09 – **Agriculture and the Measures Relating to it in the Report of the President of the Brazilian Republic.** — PESSÔA (President of the Republic), Mensagem apresentada ao Congresso Nacional na Abertura da Terceira Sessão da Decima Legislatura. Agricultura. *Republica dos Estados Unidos do Brazil*, pp. 129-172. Rio de Janeiro, 1920.

In the Report which the President of the Brazilian Republic presents every year to the National Congress of Brazil, Dr. E. PESSÔA describes the condition of agriculture in Brazil and various measures for its development. In the first place the re-organisation of the agricultural services is urgently required, especially with regard to the protection of crops against disease, and the improvement of the cultivated species with a view to obtaining better varieties.

The centre of all measures of plant hygiene will be the Biological Institute for the protection of agriculture, established for the study of diseases and infection of the cultivated and forest plants of Brazil and the means for combating them. Its establishment is an indispensable preliminary to all precautionary measures against plant diseases, which assuming special characteristics due to the climate and soil, require measures which can be adapted to different local cases.

The study of plant biology, which is allocated to the Botanical gardens of Rio de Janeiro should act as a control and guide in the organisation of all matters dealing with the economic cultivation of plants. An early reform will enable the Botanical Gardens, without injury to their traditionally scientific character, to act more directly and effectively in favour of national economies. The results of the botanical research carried on

there will be utilised by the Agricultural Institutes, which in their turn will make experiments in order to obtain the best kinds of cultivated plants.

These Institutes will serve as experimental stations and their duty will be to deal with each of the more important crops grown in the districts where they are established. As soon as the type of plant to be adopted is decided, they will have to face the problem of reproducing on a large scale the seeds and plants necessary for distributing it over the country. With this object the trial plots already in existence will be converted into nurseries, but the Institutes will not abandon their original objective, i. e. the demonstration of the best methods of cultivation. In order to guarantee the superior quality of the seeds a technical seed testing station will be set up which will control the former trial plots or others which will be established at government Institutes.

With the assistance of subsequent reform the Department of Practical Agriculture (inspection and agricultural development) will institute in every state in Brazil, and in the Federal territory of Acre, 21 agricultural inspectorates entrusted with the application of prophylactic measures of plant hygiene for the control of plant diseases, as well as with the distribution of seeds and plants selected in consequence of the improvement of the local varieties.

The seed Department will also attend to the distribution of agricultural machinery and fertilisers as well as insecticides and fungicides recommended by the Biological Institute and dépôts will be established in land which will facilitate purchase by the farmers.

There will also be distributed during the present year 446.5 metric tons of various disinfected seeds whose germinating capacity has already been tested. This quantity is sufficient to sow 38 114.5 acres. There will also be distributed 33 288 fruit trees, grafted for the most part, for the planting of 131 acres. From 1910 to December 31, 1919, the Department distributed 2000 metric tons of seeds, or sufficient for seeding 131 739 acres and more than 200,000 fruit trees for 822 acres. Of the seeds distributed, 548 m. tons represented grain fodder crops, for the sowing of 102 359 27 acres. The distributing Department furnished moreover 7.5 m. tons of fertilisers and 16 m. tons of insecticides (for ants) as well as Paris green.

The great assistance which chemistry renders to agricultural operations has encouraged close co-operation between the different departments and the already existing Institute of Chemistry. The geological mineralogical departments, also will co-operate with the departments of inspection and agricultural development. Owing to the special needs of the present moment, measures will be taken to encourage the cultivation of cotton. The application of these measures will be entrusted to an autonomous Board of Superintendence (Cotton-Service). Similarly, as the need is felt and financial conditions permit, special Boards of Superintendence will be established for the protection and development of the selected crops. Autonomous experiment Stations for sugar-cane, cacao, tobacco flax, barley, and wheat, already in existence or under contemplation will form the nucleus of the future services. The encouragement of the

levelopment and improvement of cotton growing is particularly important, specially in the North-Eastern States which are regarded as the chief producing centres in Brazil and which offer specially favourable conditions of soil and climate. The sugar industry also requires the introduction of modern methods, and should be re-organised as has been done in Cuba, Hawai, and the Philippines.

It is also necessary to develop the production of industrial alcohol and of tobacco for the growth of which, Brazil offers most favourable conditions.

The persistant decrease in the production of rubber shows the need of employing suitable methods of cultivation. The uninterrupted increase in the production of live stock necessitates the re-organisation of the Zootechnical Departments both as regards the supply of breeding stock and prophylactic measures. The importance of breeding in Brazil is revealed by the fact that whereas Brazilian exports increased by 40 % during the last 6 years the export of animal products shows an increase of 200 %.

But the breeders need to learn the importance of improving stock and in this they will be assisted by the Zootechnical Services of the Ministry of Agriculture.

Preventative measures against epizootic diseases will also be developed, but government action must be supported by sanitary regulations. Prizes and grants will be given by the Federal government for the production of thoroughbred horses. The Third National Cattle Show, which will be held from July 4 to 11, 1920, will help to stimulate the development of the animal wealth of Brazil. The Higher Agricultural and Veterinary School will be re-organised, and the courses will be improved as regards both the theoretical part and the practical and experimental side. Moreover, new chairs of agricultural zoology, applied biology, bee keeping and sericulture will be created. The teaching of agriculture will be subdivided into general agriculture, agrology, soil microbiology and specialised agriculture, forestry, the cultivation of fodder and food crops. In like manner, there will be subdivisions of general zootechnology, special zootechnology, feeding, inspection of foods, and cold storage industry; courses in industrial chemistry will be added and the practical side of the agricultural courses and related industries will be extended.

The sending abroard of students anxious to perfect their scientific knowledge has been attended with most satisfactory results. In the year 1919-1920, 19 students were sent to the United States, England, France and Switzerland.

One of the effects of the war has been to increase the export of cereals and pulse crops. The export of haricot beans and maize which has assumed special importance, has necessitated the study of measures for preserving these products. The Superintendence Board created for this purpose last year had to sterilise 13 858 bags of haricot beans and 6 361 bags of maize.

As it was advisable to amalgamate and simplify the services dealing with national production, comprised in two different departments, viz.,

the Department of Practical Agriculture and the Executive Delegation of National Production instituted in December 1917, the latter was abolished. It had distributed in the two preceding years 2 508 416 metric tons of seeds of wheat, barley, rye, oats, haricot beans, manioc, cotton, rice, various kinds of fodder, maize, flax, castor oil, ground nuts, peas, hemp, lentils, garden plants, tobacco, onions, and eucalyptus.

It also supplied 268 000 kg. of insecticides and fertilisers and circulated 270 467 pamphlets dealing with agricultural propaganda. The Board of Superintendence of cereals is authorised to sell agricultural machines at cost price, and the Department of Practical Agriculture will undertake the distribution of seeds, insecticides and fertilisers as well as agricultural propaganda.

The regulations dealing with the trade in fertilisers have also been elaborated and will shortly be ready, whilst measures for the control of insecticides and fungicides are in preparation. The chief difficulty lies in the lack of analytical laboratories, but this has in part been overcome. The precarious economic and financial condition in which the Brazilian Government has been for several years has led it to consider a system of agricultural credit and co-operation by means of local syndicates for the protection of agricultural interests, and co-operative societies dealing with credit, consumption, production, purchase and sale of crops, and agricultural implements and machinery. The Agricultural Schools for the education of foundlings have been re-organised ; 6 are self supporting, and 3 receive grants.

Forestry regulations (1) will be drawn up for the purpose of protecting the Brazilian forests. The Forecasting Service so important for Brazilian Agriculture, is at the Meteorological and Astronomical head office. The meteorological section has 235 stations at its disposal and requires at least 400, or one to every 20 000 km.

Finally, the National Museum has displayed the greatest activity through its various sections and laboratories.

710 – **Economic Wealth of Alsace-Lorraine.** — *Comptes rendus de l'Académie d'Agriculture de France*, vol. VI, N. 14, pp. 354-360. Paris, April 14, 1920.

M. MÉLINE presented to the academy M. EDMOND THÉRY'S book, *Richesses économiques de l'Alsace-Lorraine*, the chief object of which is to give a complete inventory of the resources of these departments. M. THÉRY lays special stress on the wealth of the soil and subsoil of Alsace-Lorraine and sets forth the immense progress attained in agricultural production by the use of highly perfected methods of cultivation. He shews how from 1903-1912, the average yield had risen, for wheat, from 14.75 cwt to 16.6 cwt. per acre, for barley from 18 to 26.6 cwt., for oats 14.75 to 17.7 cwt, potatoes 110.7 to 127.2 cwt, alfalfa 56.4 to 68.6 cwt.

To these general crops must be added special ones foremost among which comes that of the vine, which has placed Alsatian wines in the first rank ; they have a flavour and bouquet equal to that of the best Rhenish

(1) See No. 773 of this *Review*. (*Ed.*)

vines. The Alsatian vineyards, in spite of the ravages of phylloxera, cover a area of about 64 220 acres, and produce some 180 000 hectolitres of wine.

To the cultivation of the vine must be added that of the hop, which overs some 9 880 acres, representing nearly 8 % of the world's production. he Alsatian hops are of first class quality. The cultivation of tobacco ccupies about 9 000 planters and produces 92 080 cwts.

Breeding has made considerable progress in Alsace Lorraine ; from 883 to 1912 it has steadily increased. During this period the number f cattle rose from 429 000 to 523 000 head, the number of pigs from 22 000 to 431 000, but that of horses alone remained stationary and sheep ad decreased. It is estimated that during this interval the value of the lsatian herds had increased from 200 million to nearly 320 million marks, ut this capital had been seriously encroached upon by the war.

The value of the forests had risen still higher. Inspector-General AFOSSE estimates the value of the demesnial forests of Alsace-Lorraine t not less than 406 million marks, with an average value of 2 542 marks er hectare, but these are the prices of 1917 and the present value of the orests would be more than 800 million francs.

The subsoil of Alsace Lorraine is perhaps, considering its small area, he richest in the world for the importance and value of its deposits. The rincipal mineral is iron ore in the celebrated basin of Longwy-Briey, which nables France to add to the 18 million tons of iron ore from the basins of Briey and Longwy which she already possessed and 20 million metric tons rom Lorraine and thus to become with the United States the richest ountry in the world as regards iron ore. The deposits of potash in Alsace re estimated to contain 250 million metric tons.

11 – **Agricultural Monograph of the Region of Urundi, a Former Province of German East Africa.** — De Greef, G. (Veterinary Surgeon in the Belgian Congo), in *Bulletin agricole du Congo Belge*, Vol. X, Nos. 1-4, pp. 3-69, 20 phot., 1 map. Brussels, March-Dec., 1919.

Urundi is a province of the former German East Africa, occupied by Belgium. It is bordered on the north by the Ruanda, on the east by the Ussuwi, on the South by the territory of Udjidji, and on the west by the district of the Kivu. At its greatest breadth it is bounded by natural frontiers formed by the rivers Rusizi, Akanyaru, Nyavarongo, Malagatasi, nd Lake Tanganyika. It is a country which, although situated in the ropical zone, is temperate on account of its high altitude, which varies rom 820 metres (altitude of Lake Taganiyka) to 2500 metres (Mount Musumbwa).

In Chapter I the author deals with general headings : — Agrology, ydrography, orography, vegetation, composition of the soil, and climate.

In Chapter II, he studies native agriculture : — *A*) cultivated food plants ; *B*) plants for various uses, European vegetables, fruits, bee keeping.

Chapter III deals with methods of cultivation: Chapter IV with the choice of ground, crops, etc.; Chapter V with population, customs occupations; Chapter VI with local breeding, and Chapter VII with the hygiene conditions of the live stock.

RURAL HYGIENE

712 – **The Nitrogen Balance and Lack of Vitamines.** — DESGREZ, A. and BIERRY, H., in *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 20, pp. 1209-1211. Paris, May 17, 1920.

In order to determine the balance ration in adults it is usual, at any rate as regards nitrogen, only to take as criterion the maintenance of weight and chemical composition. Although quite legitimate, this method is not of absolute value, for though the nitrogen equilibrium expresses a fundamental condition this is but one condition only of the total equilibrium.

From this point of view there is reason for investigating the question as to whether the nitrogen equilibrium is not liable to be influenced by the nature of the food, and also if, in a crude ration of sufficient calorific value containing the indispensable materials, it is not necessary for the constituent elements to be present in certain proportions varying according to their structure and chemical functions, in order that the animal may obtain an adequate supply of the required constituents. This implies the investigation of the extent to which isodynamic food principles may be isotrophic. This equilibrium can be obtained, for a time at least, in an animal living on food which is rich or deficient in vitamines, and the authors examine the latter case.

In their experiments, adult male rats were put on a diet composed of salts, water, egg albumen, pure sugars (saccharose, lactose, and fructose), and prepared fats free from nitrogen. Account was taken of the quantity of sugar supplied by the albumen itself.

The salts remaining fixed in amount, the proportion of the 3 elements albumens, sugars, and fats, was varied, in a ration of about the same energy value so as to maintain the weight at the same level, and to ensure the nitrogen equilibrium. Firstly, if the rat is suddenly changed from ordinary diet to a synthetic one containing a large proportion of albumen and fat as compared with sugar, the animal rapidly loses weight and nitrogen.

If the quantity of albumen and fat is then reduced and the proportion of sugar increased, the nitrogen equilibrium is soon recovered. The functional chemical action of sugar is rapidly manifested, especially in the case of levulose.

By allowing the rats to adapt themselves by degrees to the synthetic food containing the elements in suitable proportions, it is possible, avoiding constipation however, to keep the animals in nitrogen equilibrium for 25 or even 35 days before the results of lack of vitamine become marked.

CONCLUSION. — Rats can be maintained for a certain time in nitrogen equilibrium on a diet deficient in vitamines, with variable proportions of albumen, fat and sugar in a given ration of sufficient heat generating value.

The minimum of each of the 3 elements is dependent on the chemical nature and ratio of the other 2 elements.

The minimum of nitrogen is reached when a certain proportion of sugar is present in the ration.

13 – **Agricultural Education in Belgium.** — I. Ministère de l'Agriculture, *Situation de l'Enseignement agricole, Rapport triennal, avec annexes, présenté aux Chambres législatives, par M. le Ministre de l'Agriculture*, years 1912, 1913, 1914, 1915, 1916, 1917, xxvi pp. 412. Brussels, 1919. — II. Royaume de Belgique, Ministère de l'Agriculture, *Institut Normal Supérieur d'Economie ménagère agricole.* Brussels, 1920.

In Belgium the organisation of agricultural education is not solely in the hands of the Ministry of Agriculture. The Law of April 4, 1890, which supplemented that of July 18, 1860, permitted the promoters of this branch of education to spread over the country a wide network of classes and schools of all kinds, which are still working. This Law modified the functions of the Institut de Gembloux, amalgamated the agricultural sections with the Horticultural Schools of Vilvorde and Ghent, created a State School of Practical Agriculture (now established at Huy), and allotted grants to agricultural schools and courses attended by at least 15 pupils, taking the official syllabus and satisfying the State Inspectors. When the Bill was passed, the Directorate of Agricultural Education endeavoured, by its administrative regulations, by its permanent staff of inspectors, and by the allocation of grants, to organise various institutions on the right lines. The results were such that after 12 years' experience it was possible to draw up a general Code of official regulations dealing with agricultural education.

This code, which is contained in 22 pamphlets, each applying to a type of agricultural school or course, now serves as a valuable guide to those who are interested in the diffusion of agricultural knowledge. The regulations thus drawn up are observed by all the institutions which are under State Inspection, which are as follows :

A) SCHOOLS FOR BOYS.

(*a*) Higher Grade (Degré Superieur) : Institut agricole de l'Etat at Gembloux.

(*b*) Higher Intermediate Grade (Degré Moyen Supérieur) : Agricultural Sections.

(*c*) Higher Primary Grade (Degré Primaire Supérieur) : attached to these Grades are :

(1) *Primary professional sections.*

(2) *Travelling, professional agricultural sections,* organised and directed by the State agronomists.

(3) *Schools, sections and courses of agricultural mechanics,* whose number increases yearly, and which may be considered as professional sections with a specialised syllabus.

(4) *The Agricultural courses* organised in the State " athénées " and Intermediate Schools and in free " Collèges " and intermediate schools might, as regards their scientific standard, be considered as belonging to Lower Intermediate education. But the short amount of time allotted to this subject would rather class these courses, which do not aim directly at the professional training of farmers, with primary agricultural education.

(*d*) LOWER PRIMARY GRADE OR INSTRUCTION FOR ADULTS: A large number of lectures on various subjects given to adult farmers and to soldiers during the winter.

B) SCHOOLS FOR GIRLS.

(*a*) HIGHER GRADE: *Agricultural Training Colleges* at Héverlé and at Wavre Notre Dame; *Higher Training Institute* of Domestic and Agricultural Science at Laeken (Brussels).

(*b*) INTERMEDIATE GRADE: Permanent Schools and Sections of Domestic and Agricultural Science.

(*c*) LOWER GRADE: (1) Travelling schools of Domestic and Agricultural Science.

(2) *Primary professional Sections for girls.*

(3) *Lectures for farmers' wives.*

The organisation of these different kinds of institutions is as follows:

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A) AGRICULTURAL EDUCATION FOR BOYS.

(*a*) HIGHER AGRICULTURAL EDUCATION. — The *Institut agricole de l'Etat à Gembloux*, as well as the *Institut agronomique de l'Université de Louvain*, trains the heads of large agricultural enterprises, the directors of agricultural industries, landowners, professors of agriculture, State agronomists, the higher officials in the Department of Woods and Forests, etc. The regular students, Belgians or foreigners have to furnish a *certificat d'études moyennes complètes* (secondary school certificate) and pass an examination in mathematics. The only pupils exempted from these formalities are those who have entered the Military School, or a technical school of a university leading to an engineering degree.

The period of study last for 3 years, and the syllabus includes the following courses: — Cultivation, rural engineering, general chemistry, mineralogy, analytical chemistry, zootechnology, botany, zoology, book keeping, rural economy, social economy or legislation, technology, drawing and physics. The teaching comprises lessons, repetition, experiments an excursions. A model farm is attached to the Institute which serves both for practical teaching and as an experimental farm.

(*b*) HIGHER INTERMEDIATE EDUCATION. — This system of education is represented in Belgium by the free schools of Carlsbourg, La Louvrière, Leuze, and by the State School of Practical Agriculture at Huy. The last mentioned school is run on special lines, and it is supported by the State. The object of these schools is to train the heads of the smaller farms, directors of secondary agricultural industries, farm managers, etc. The period of study lasts for 3 years, except at Huy, where it only lasts two.

Pupils are admitted after finishing their higher primary or lower intermediate education. The number of hours allocated to agricultural studies (the minimum of which is fixed by ministerial decree) may not be less than 40 hours per week; 6 hours of theoretical and 6 hours of practical

work, in the third year. The syllabus includes the following compulsory essential courses and optional courses: — *Compulsory:* physics, chemistry, botany, zoology, agronomy, agricultural chemistry, zootechnology, special crops and book keeping; *Optional:* — Analytical chemistry, fruit growing, market gardening, forestry, poultry keeping, entomology, bee keeping, agricultural mechanics, rural buildings, and technology.

The 3 free schools mentioned above have added to their syllabus, in addition to the compulsory courses, the greater part of the optional courses, and the free time in the week (which comprises 28 to 30 hours of lessons each year) is devoted to the study of general knowledge.

(*c*) LOWER INTERMEDIATE AGRICULTURAL EDUCATION. — The "Lower intermediate" agricultural sections are established throughout the country. They are attached to free institutions, of general education (colleges, intermediate schools), and generally comprise a 3 years' course taken by pupils of from 14 to 17 years of age. The minimum syllabus required by the Ministry of Agriculture includes the following:— physics, chemistry, botany, zoology, agronomy, agricultural chemistry, zootechnology, and book keeping.

The greater part of the schools and intermediate agricultural sections therefore do not teach what is usually known as "practical agriculture," i. e., they do not teach the pupils to plough, harrow, sow, etc. But it must be observed that the pupils are mostly farmers' sons, living at home and thus in close contact with the work of the farm. It is there that they acquire the practical side of agriculture and professional ability much better than in the best of schools, as the naturally heavy scientific syllabus takes up all the time. The object of the Intermediate School of Agriculture is to teach the pupils the scientific basis of agriculture.

(*d*) HIGHER PRIMARY GRADE.

(1) *Primary sections of professional agriculture.* — These sections were started tentatively in 1901-1902. They may perhaps be compared to the winter schools of agriculture which exist in certain countries. They are, indeed, open during the winter season which is a slack time for the worker in the fields. At first all these sections were attached to the Primary Rural Schools; the teaching there was given by a master holding a Diploma for the teaching of agriculture. Afterwards their scope was enlarged and at the present moment there are in existence independant sections of the Primary Schools.

The Syllabus of the primary professional agricultural sections comprises general agriculture, agricultural chemistry special crops, some knowledge of animal anatomy and physiology, the feeding and management of animals (cattle, horses, pigs, poultry), agricultural societies, and book keeping.

This syllabus is not enforced *ne varietur*. It can be adapted to regional requirements, and in practice, the greater number of the sections have modified it according to the needs of their students.

These winter professional agricultural sections have met with great success as is proved by the figures of the attendance registers.

At first sight these winter sections may be confused with the agrono-

mic lectures given during the same season, in a large number of Belgian communes. However, these two systems of education are quite distinct as regards their duration, their syllabus, their methods and their examinations; the agronomic lectures comprise 10 or 15 lessons of about an hour's length, 6 to 10 of which are given to the study of fertilisers and of cattle-feeding: 1 or 2 lessons deal with hygiene, rural law, agricultural associations, etc. The development of these various points is naturally limited to facts capable of being applied practically, and the teaching is in the form of a lecture, the professor endeavouring to place himself in the level of his audience, but generally speaking he does not ask questions; those present reserve their difficulties and remarks for the discussion which usually terminates the lecture.

(2) *The travelling professional sections.* — These constitute a very interesting variety of the preceding sections. Whereas the latter are held every year in the same place, the travelling sections travel about from year to year, establishing themselves wherever they find a suitable locality and a sufficiently large audience (a minimum of 15 pupils). These travelling sections were started in 1904-1905 in the province of Namur.

Afterwards they increased, and at the present moment, the State Agronomists have organised them in the provinces of Namur (2 schools), Brabant, Limbourg (2 schools), Liège (2 schools), Hainaut (2 schools) and Antwerp.

Their system is based on that of the stationary sections, viz., the courses are given during the 3 winter months at the rate of 3 or 4 lectures of 3 to 4 hours per week.

The syllabus is fixed by the Minister in conjunction with the Direction of State Agronomy, who takes into account the requirements of local agriculture.

The greater number of the agronomists have added to the usual syllabus lessons of practical agricultural mechanics (the working, maintenance, etc., of agricultural machinery).

(3) *Schools, sections and courses of agricultural mechanics.* — By reason of the necessity which compels the farmers to have more and more recourse to agricultural machinery, or account of the lack of manual labour. Schools and courses of agricultural mechanics respond to a real need and their popularity is easily explained.

There are now 3 schools in existence at Mons, Leuze, and Namur, and 2 sections at Avelghem and Fleurus. Moreorer in the provinces of Brabant and Liège the State agronomists have established travelling sections which are open during the winter and move from one place to another every 2 or 3 months. Finally, courses of agricultural mechanics of 10 to 15 lessons are organised in the provinces of Namur, Limbourg and Luxembourg.

In the schools and sections the teaching is both theoretical and practical. Theory comprises elementary knowledge of agronomy, natural sciences, and legislation applied to agricultural mechanics; the description of agricultural machines steam, petrol, electric tractors, etc. Practica

work is chiefly confined to drawing, the fitting, taking down, and running of agricultural machinery, driving the tractors and working in wood and iron with a view to doing slight repairs.

To allow of this practical work being carried or under favourable conditions the schools in particular and the sections have put up large workshops which suffice for all needs.

Ambulatory sections of agricultural mechanics. — Established in 1912 by the State agronomists of the provinces of Brabant and Liège, these sections are financed entirely by the State with the exception of grants awarded by the provinces and certain agricultural societies.

With a syllabus and institutions similar to those of the permanent schools and sections, though on more modest lines because of their temporary character, these travelling schools, however, render great service.

Courses of agricultural mechanics of 10 to 15 lessons have been organised by the State on the initiative of its agronomists in the provinces of Lembourg, Namur, and Luxembourg, and by some professional sections of agriculture (Enghien, Thuin). They are given up entirely to the study of the working, assemblage, etc., of agricultural machinery employed or suitable for use in the district.

This strictly utilitarian syllabus has been greatly appreciated by the large numbers present at these lectures (an average of 20 to 50 per lesson).

(4) *Agronomic courses organised in official and free establishments.* — These courses were organised at the joint expense of the Departments of Science, Arts and Agriculture in 50 State "athénées" and Intermediate Schools, and at the sole expense of the Department of Agriculture in 50 free establishments; they comprise 1 or 2 hours of lessons weekly, given by an agricultural engineer or a professor of an Intermediate School. The syllabus includes the study of plants, animals, and agricultural associations. These courses do not afford training for the farming profession and that indeed is not their object. They are intended for young men some of whom, after their "études moyennes" will return to the paternal farm, with at least some notions of agricultural science, whilst others will proceed to universities to become notaries, lawyers, doctors, finally settling in the country where they will occupy important posts. It is thus very likely that they will have frequent opportunities for taking, to some extent expert, an interest in the affairs of the rural community in which they live.

(*e*) Lower Primary grade or Instruction for Adults.

(1) *Agricultural lectures for adults.* — These have been given for a great number of years in Belgian villages by the state agronomists, agricultural engineers, professors and masters holding teaching certificates for agriculture. They deal with various subjects of interest to farmers, such as fertilisers cattle feeding, hygiene, dairies, associations, rural law, means of combating the diseases and pests of plants and animals, apiculture, poultry farming, farriery, etc.

(2) *Courses in agriculture for soldiers* are regularly organised every winter from December to March in the barracks where at least 20 entries are received.

(3) Finally for some years past free agricultural associations and federations have instituted lectures with the financial aid of and inspection by the State.

(*B*) AGRICULTURAL EDUCATION FOR GIRLS.

(*a*) HIGHER GRADE. — The Higher Grade of education in Domestic Agricultural Science is represented in Belgium, since 1918, by the institution of a fifth year of specialised agriculture in the training Colleges for Certificated Mistresses (Ecoles Normales d'institutrices agréées) at Wavre Notre Dame and at Héverlé. In October, 1920, the courses of the Higher Grade Training Institute of Economic, Domestic and Agricultural Science will begin at Laeken (Brussels). These Agricultural Training Colleges are instituted for the training of future mistresses who teach domestic science in rural primary schools, but they also provide the necessary training for professors of professional schools of Agricultural Domestic Sciences.

Their syllabus comprises all the branches pertaining to woman's sphere of work in the country. The utility of these higher sections for the progress of agricultural domestic science teaching is incontestable.

(*b*) INTERMEDIATE GRADE. — In the Intermediate Grade, Belgium has permanent schools and sections of Agricultural Domestic Science.

(1) *Schools of Domestic Agricultural Science.* — They are scattered thoughout the various provinces of the country and form the Higher Intermediate Grade of this form of education. Generally the period of study usually lasts 2 years, and residence is the rule. Their syllabus comprises some instruction in natural science and agriculture, market gardening, flower growing, elements of zootechnology, dairy work, cheesemaking, domestic economy (cooking, sewing, etc.), infant welfare, hygiene, commerce, book keeping, and common law. The teaching staff is generally composed of mistresses of primary schools holding a diploma in Domestic Agricultural Science. The ministerial regulations prescribe a minimum of 10 hours of theoretical and 20 hours of practical work weekly in this course (dairy-work, cheese making, gardening, domestic economy, etc.).

(2) *Sections of Domestic Agricultural Science.* — These constitute the Lower Intermediate stage. The essential difference between their organisation and that of the schools is the shorter period of study. The syllabus extends over a year, and includes the study of the principles of agriculture applied to gardening, of dairy-work, cheese making, domestic economy and book keeping. Theoretical and practical work is to occupy at least 4 hours respectively per week.

(*c*) ELEMENTARY GRADE.

(1) *Travelling schools of domestic agricultural science.* — These schools constitute one of the most interesting features of agricultural education for girls in Belgium. For some years past their organisation has been adopted in different countries, particularly in France, where some of the mistresses of the Belgian travelling schools have been appointed temporarily to the management of the newly created departmental schools. These travelling schools correspond to the travelling agricultural schools

for boys with, however, the difference that the latter are only held during the winter whereas the former continue throughout the year.

At the request of the Communal authorities, official or independant agricultural societies and private individuals, the school is installed in succession in the Communes where there are suitable quarters and a sufficient number of pupils (15 to 20). It is intended for girls who have completed their primary education and are able to follow the work of the school. There are no school fees. The school syllabus comprises the study of dairying, cheese making, domestic economy (cooking, sewing, laundry, work, household management, care of utensils and furniture, etc.), hygiene infant welfare gardening (market gardening), aviculture, feeding human beings and farm stock (milch cows, pigs, poultry).

The teaching is both theoretical and practical. In the winter, the practical work is done in the morning (from 8 to 12 a. m.) and the theoretical lessons are given in the afternoon (from 1 to 3 p. m.). In the summer, the working hours are from 7 a. m. to 1 p. m. (practical from 7 to 8 a. m. and from 10 a. m. to 1 p. m., theory from 8 a. m. to 10 a. m.; or theory from 7 to 9 a. m. and practical from 9 a. m. to 1 p. m.). For the theoretical study of certain branches, such as domestic economy and dairying, the pupils generally use text-books. If these are not available, the professor supplies or dictates a summary of his lessons.

The practical work dealing with the different branches is carried on with the help of the apparatus which all the schools have. Apparatus for dairying and cheese-making (1 or 2 separators, a churn, a kneader, a refrigerator, utensils for making cheese, testing milk, etc.). For the practical work the pupils are divided into 4 groups of about 4 or 5 pupils to the group; the first group attends to the testing of the milk and the butter and cheese making. The second has charge of the kitchen (preparation of the mid-day meal, which the pupils of the group take at the school; bread-making, preservation of fruit and vegetables; waiting at tables, etc.). The third washes and irons, etc.; the fourth takes sewing (cutting-out, making and mending linen, simple garments and those most in use). Each group does the same work for 8 consecutive days, then they change round so that in 1 month the 4 groups have covered the whole ground. After 4 months, the pupils have therefore participated 4 times in each operation. The results attained by this itinerant system of domestic agricultural teaching are surprising.

(2) *Primary professional agricultural sections for girls.* — These sections correspond to the primary professional sections for young men. They are based on the same official regulations, which require 60 hours of theoretical lessons and 60 hours of practical work to obtain a grant varying from 350 to 750 fr.

The syllabus is a modified form of that of the permanent sections of domestic and agricultural science. The latter are intended for girls who can follow uninterruptedly a whole year's studies, whereas the primary sections are open to those who can only give a few hours a week and wish

to perfect themselves while at the same time they go on with their regular work at home.

(3) *Lectures for farmers' wives.* — In order to complete the system of education instituted for the benefit of country-women the Ministry of agriculture has organised during the last 10 years lectures on the different subjects of interest to the farmer's wife i. e., cattle-feeding, dairy-work, poultry keeping, growing vegetables, domestic economy (cooking, preserving of vegetables, etc.) infant welfare, hygiene, etc.

These lectures are instituted by the State at the recommendation of official agronomists or through the medium of circles or federations of circles of farmers' wives.

They have everywhere met with the greatest success.

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Agricultural instruction in Belgium is given, in its different grades and forms, by the following institutions :

HIGHER AGRICULTURAL EDUCACTION.

State Agricultural Institute at Gembloux.

INTERMEDIATE AGRICULTURAL EDUCACTION.

State Intermediate School of Practical Agriculture, at Huy.

Free grant-aided agricultural schools for boys at Carlsbourg, La Louvière, and Leuze.

Free grant-aided agricultural sections for boys at : Aerschot, Avelghem, Buggenhout, Capelle-au-Bois, Chimay, Court-St-Étienne, Dinant, Ellezelles, Enghien, Fleurus, Hal, Hasselt, Opwyck, Saint-Trond, Schadeck-Attert, Sottegem, Thielt, Thouin, Tirlemont (Collège Notre-Dame), Tirlemont (École provinciale), Virton, Visé, Waremme, Waterloo, Wawre.

Free grant-aided domestic and agricultural Science Schools for girls at Bastogne, Berlaerlez-Lierte, Bouchont, Brugelette, Celles (Hainaut), Ciney, Cortemarck, Gooreing-Wuestwezel, Gysegem, Herve, Héverlé (Higher School of Agriculture for girls), Mauble, Overyssche, s'Gravenwezel, Tessenderloo, Virton.

Grant-aided domestic agricultural science sections at Appelterre, Balegem, Champion, Jodoigne, Ressegem, Waremme, and Zeelhem.

Agronomical Courses attached to private institutions and *Agronomical Courses in the " Athénées royaux " and Intermediate State Schools* (About 100 lectures are organised every year in normal times).

ELEMENTARY AGRICULTURAL EDUCACTION.

Primary professional agricultural sections for boys at : Anseghem, Ath, Aywaille, Bassevelde, Beauvechain, Bergilers, Braine-le-Comte, Brugelette, Dilbeek, Frasnes-lez-Buissenal, Huldenberg, Lichtaert, Londerzeel, Moll, Nodebais, Peruwelz, Proven, Saint-Gilles (Waes), Tirlemont, Thielen, Westerloo.

Grant-aided schools of agricultural mechanics at at Avelghem, Fleurus, and Leuze.

Professional agricultural schools and temporary schools of agricultural mechanics for young men.

Primary professional agricultural sections for girls at Borsbeke, Buret, Tavigny, Heverlé, Ter, Bank, Vezon (Hainaut), Vorst. (These usually each have about 20 pupils).

Travelling domestic agricultural science schools. During the 3 years 1912-1914, 55 courses very well-attended, were organised. The number of girls wishing to attend these schools is always much larger than space admits, which is a proof of the great utility of these courses.

POPULAR AGRICULTURAL EDUCATION.

Lectures given by State Agronomists. Generally given on the occasion of a meeting of agricultural or other Societies: these meetings afford opportunity for the agronomists to make themselves known to the farmers.

Agricultural lectures for adults (more than 2000 yearly).

Lectures for farmers.

Agricultural courses for soldiers (406 in 1914).

Lectures on poultry-keeping (428 in 1913-1914).

Lectures on bee-keeping (487 in 1913-1914).

Special lectures (organisation of agricultural loans at reduced interest, demonstration of rational feeding of cattle, experimental plots; the latter have facilitated the comparison of the returns afforded by different kinds of cereals; potatoes, beetroot; they have also shown the advantage of using fertilisers.

STATE HORTICULTURAL SCHOOLS.

State Intermediate Schools of Practical Horticulture at Vilvorde (Ghent).

GRANT-AIDED SCHOOLS OF HORTICULTURE.

Horticultural Schools at Carlsbourg, Liège, Mons, Tournai.

Horticultural Sections for men at Affligem, Antwerp, Alost, Avelghem, Hoeylaert, Knesselaere, La Louvière, Lesdain, Lokeren, Mont-Saint-Amand, Namur, Overyssche, Roulers, Seraing, Tihange, Verviers, Weselmael, Wetteren, Zele. — For girls at Remagne (Rondu).

Lectures on Fruit growing at Antwerp, Bornhem, Malines, Lennicq-St-Quentin, Nivelles, Tirlemont, Vilvorde, Bruges, Roulers, Waereghem, Alost, Ghent, Grammont, Sottegem, Ath, Tournai, Huy (Statte), Liège, Hasselt, Tongres, Gembloux, Namur.

Lectures on Market Gardening at Antwerp, Tirlemont, Vilvorde, Ghent, Grammont, Tournai, Huy, Liège, Hasselt.

Temporary courses of Fruit growing (in 20 lessons on commercial methods of planting and exploiting Orchards; the teaching, of the theory and practice of espalier fruit growing in the localites where this form of plantation is advisable, etc.).

Temporary courses of Market Gardening (in 20 lessons dealing with modern commercial methods).

Lectures on Fruit and Flower growing and Market Gardening whose main object is to introduce new methods into the professional centres.

STATE CENTRAL SCHOOLS OF PRACTICAL FARRIERY at Molenbeek St. Jean.

INSTITUTIONS ATTACHED TO THE TEACHING OF AGRICULTURE: *Station of agricultural chemistry and physics, State Station of Dairying, Station of phytopathology, Station of agricultural entomology, Station for the improvement of seeds,* attached to the Agricultural Institute of Gembloux. These stations also have an information department for the benefit of farmers.

State Botanical Gardens at Brussels.

Agricultural libraries (149 in 1914).

The estimates for agricultural education, the cost of which was defrayed by the State, allotted in 1914 489 310.75 francs for agricultural instruction, and 191 619.02 francs for horticultural instruction. In the same year the Institut de Gembloux disposed of a sum of 136 625 francs for the staff and 47 200 francs for apparatus: the state Intermediate School of Practical Agriculture at Huy had at its disposal 26 575 francs for the staff and 13 200 francs for apparatus, etc.

In 1914, the grants made to free agricultural schools and sections always varied from a minimum of 1275 fr. to a maximum of 5000 fr.;

those apportioned to the grant-aided domestic and agricultural schools and sections varied from 245 to 6600 fr. The total grants amounted to 21 255 fr. for the primary professional agricultural sections ; 18 625 fr. for the courses in the private institutions of Intermediate education, 40 000 fr. for agricultural courses for adults ; 8 000 fr. for agricultural courses for soldiers, 6300 fr. for courses in bee-keeping ; 6 250 fr. for courses in poultry keeping, 15 750 fr. for lectures on agricultural subjects given under the patronage of independant agricultural associations, and 20 780,75 fr. for travelling agricultural schools.

The report reviews the conditions in each of these institutions during the scholastic years from 1912-13 to 1916-17 and their position at the end of hostilities. Many of the schools had lost, during the period of the war, their scientific collections and libraries, etc., this being particularly the case with the Institute of Gembloux. During the 6 scholastic years from 1912 to 1917 this Institute was attended respectively by 164, 179, 157, 75, 65, and 117 pupils.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY

714 – **Meteorological Stations in Ecuador.** — Goding, F. W., in the *Monthly Weather Review*, Vol. 48, No. 2, pp. 99-100. Washington, February, 1920.

Given the importance of forecasting weather conditions, a question already conceded in many countries, for the benefit of the agriculturist, the technical Office of the Association of Agriculturists of Ecuador has decided to inaugurate a network of stations throughout the coastal provinces, including the Galapagos Islands, particularly with relation to tropical crops.

With this object in view 50 farms have been selected at convenient distances, each being provided with maximum and minimum thermometers and rain ganges ; observations on the temperature and rainfall will be recorded daily, as well as the rate of plant growth. These observations will be published in a quarterly bulletin.

With data collected during several years it will be possible to forecast approximately what the weather will be for the month and season as well as the frequency of adverse conditions.

These determinations will enable the farmer to calculate in advance, as far as possible, the most favourable time to plant and harvest the various crops.

Stations have thus far been established at Baba, Barraganetal, Chobo Rocafuerte, and Tonguel.

715 – **The Climate of Cyrenaica with Special Reference to its Influence in the Cultivation of Cereals.** — Monti, G., in *L'Italia agricola*, Year VI, No. 11, pp. 325-336, 5 plates. Piacenza, Nov., 1919.

There are 2 winds of special importance with regard to the cultivation of cereals : one beneficial the other injurious, namely, the north west wind fresh and wet, and the " ghibli " or desert wind which blows from the south. The strong winds of the south begin to blow in October and cease

in June, thus accompanying the entire vegetative growth of the cereals. They are most injurious during the months of April and May, especially in the latter half of May, because this period exactly corresponds with that of the formation of the grain, just when the plant requires a maximum of nourishment. The " ghibli " is a great obstacle to nutrition and, consequently, to the formation of the grain becauses it increases evaporation from the soil as well as transpiration, but it keeps the atmosphere dry and thus prevents the development of fungoid disease. Rust is almost unknown in Cyrenaica except at the bottom of some excessively damp valleys.

The north-west winds blow all the year round and their action is particularly favourable in the spring, when they prevail over the south wind and refresh the air, causing a fall in the temperature and increasing the moisture in the atmosphere, thereby avoiding the danger of scorching.

Temperature. — The average annual maximum temperature is 21.60° C and the average annual minimum temperature is 11.48° C, so that the average annual thermometrical variation is about 10° C. It can be affirmed that the difference between the day and night temperature is rarely more than 10° C ; the climate is then, strictly Mediterranean in type. The maximum temperatures occur in the months of June, July and August and it is exceptional for the thermometer to exceed 40° C. The minimum temperatures occur in February ; it is very unusual for the thermometer to fall to zero. During 4 years' observations the lowest temperature reached was + 1° C.

The following are the average temperatures, for each month in the year : — January, 8.71° ; February, 9.47° ; March, 12° ; April, 16° ; May, 18.12° ; June, 23.83° ; July, 24.60° ; August, 23° ; September, 17° ; October 14° ; and December, 11.23°. The important time for sowing is between the end of October and the end of December. Germination is rapid and during the succeeding months, vegetative development never stops. The month of January, with an average low temperature, greatly favours tillering ; March and April have temperatures which favour amazingly first the vegetative growth and then the inflorescence. May with its average of 18° C favours slow ripening in the hot weather of early June. It can therefore be concluded that the climate, as regards temperature, is very favourable to the development of all autumn and spring crops and, consequently, to production of cereals.

Light. — Generally speaking the sky is very brilliant and it is very rare to have the sky overcast for the whole day, whilst fogs are almost unknown. The months of December, January and February, have the greatest number of dull days ; the months with the largest number of fine days are May, June and July. Taking an average of 100 days, in one year there are : — 17 % dull days, 42.20 % cloudy days and 40.50 % fine days. From this point of view also, the conditions are excellent for the development of the chlorophyl tissue. The light is intense especially in the spring when the plants reach their highest point of development.

ATMOSPHERIC PRECIPITATIONS. — Snow and hail are unknown and sleet falls only on very exceptional days, melting as soon as it reaches the ground. Rains are usually frequent and, what is most important, well distributed. From observations taken during 3 years and reliable information it appears that rain falls from October to the beginning of May. In October and November the fall is slight but sufficient for the germination, of the seed. The rainfall for the whole of 1917 was 25.2 in. The rainfall during the period of growth of cereals from October, 1916, to May, 1917, was 14.3 in., and the rainfall during the growth period of cereals from October, 1917, to May, 1918, was 25.9 in. From observations extending over 3 years the following average data vere obtained for atmospheric precipitations during the growth period of cereals: —September *nil*; October 2.1 in.; November 1.2 in.; December 3.3 in.; January 3.3 in.; February 2.9 in.; March 2.7 in.; April 0.65 in.; May 1.2 in.; June, *nil*. Torrential rains seldom occur and the rain falls gently, often accompanied by wind. From certain information it can be concluded that, during a period of 10 years, it is possible to count on 4 wet years with more than 19.5 in., on 4 years with an average rainfall of 11.7 in. to 19.5 in., and on 2 dry years with less than 11.7 in.

SOWING TIME AND METEOROLOGICAL CONDITIONS. — The following are the returns for barley.

Growth Period	Harvest time	Cwt. per acre	
		Grain	Straw
End of November	May 10	11.23	18.37
Mid December	May 20	9.08	13.27
December	June 10	4.1	7.9
January	June 10	2.65	2.65

These data show clearly (if the factors of labour, quantity of seeds method of sowing remain the same) that the crops obtained, both for wheat and barley, are directly related to the period of sowing; if the seed is sown early, the harvest is earlier and the yield is considerably larger.

These data therefore indicate early sowing; indeed it is obvious that it must be so, because in zones where there is not much rain, and where at the end of April it ceases entirely, every effort must be made for the cereals to ripen, soon after the first fortnight in June for wheat, and similarly in May for barley. If the ripening process takes place within these limits there will always be sufficient moisture in the soil to nourish the seeds. The best season for sowing is from October onwards, as soon as the ground is soft (rain penetrates to about 10 cm. in compact soils) until the end of December.

716 – **The Climate of California and its Effect on the Growth of Fruit Trees and Vines.** — WICKSON, E. J., in *The California Fruits and How to Grow Them*, pp. 9-24, San Francisco, 1919.

The chief characteristics of the Californian climate are :— freedom from extremes of low temperature ; an abundance of sunshine ; an atmosphere with a low percentage of humidity.

THE FUNCTION OF HEAT IN FRUIT PRODUCTION. — The temperature conditions may preclude the success of a fruit tree either by destroying it outright, by dwarfing it, or by preventing it from setting or ripening its fruit. Extremes of temperatures may lead to the death of plants, whilst insufficient or excessive mean temperatures may prevent the formation of fruit without killing the plant.

The following figures indicate the lowest temperatures in several Californian localities (coast and coast valleys, interior valleys, and foothills) :

(1) *Coast and Coast Valleys :* — Eureka 11.1° C ; Ukiah 6.6° ; Cloverdale 9.4° ; Napa 10.0° ; San Francisco 6.1° ; San José 10° ; Gilroy 11.1° ; San Miguel 6.1° ; Los Angelos 15° ; San Diego 13.3°.

(2) *Interior Valleys :* — Redding 10° C ; Red Bluff 10° ; Oroville 8.3° ; Marysville 10.5° ; Sacramento 10.5° ; Merced 8.8° ; Fresno 9.4° ; Tulare City 10° ; Colton 10.5° ; Imperial 11.1°.

3) *Foothills :* Nevada City 2.2° ; Colfax 4.4° ; Auburn 6.6° ; Jackson 5.5° ; Porterville 10° ; Redlands 10°.

In cannot be said that in any region of California there is any reason therefore to fear winter killing of fruit trees. The absence of extremes of temperature, and the very long growing season combined with the summer heat are sufficent to ensure uniform ripening of the grape, a fruit very exacting in respect of temperature.

BOUSSINGAULT has shown that there should be a month at least, the mean temperature of which does not fall below 19° C, to ensure a thorough ripening of the grapes. In California, this temperature is maintained throughout the whole summer instead of lasting only 1 month.

TABLE I. — *Average Summer Temperature in California.*

Coast and Coast Valleys	Temperature °C.	Interior Valleys	Temperature °C.	Foothills	Temperature °C.
Upper Lake.	30°.0	Redding	26°.6	Auburn	23°.8
Napa.	18°.3	Oroville	26°,1	Colfax	23°.6
Livermore	20°.5	Marysville	25°.5	Georgetown.	29°.4
San José.	19°.4	Sacramento. . . .	22°.2	Caliente	27°.7
Hollister	18°.8	Merced.	26°.1	Fall Brook	20°,0
Santa Barbara . . .	18°.3	Fresno.	26°.1	Redlands.	25°.0
Los Angelos	21°.1	Tulare.	25°.5	San Bernardino. . .	23°.6
San Diego	20°.0	Riverside.	22°.7	San Jacinto	23°.6

High temperatures are accompanied by slight cloudiness, and, consequently, an abundance of sunshine, which is essential for the normal ripening of fruit. Table II gives the data for the normal cloudiness in California, rated from 0 to 10.

An interesting comparison may be made between these and the data referring to the eastern regions of the United States, where fruit growing is much less developed, and where vines are limited to small areas favourable to cultivation for topographical and hydrographical reasons (see. Table III).

TABLE II. — *Normal Cloudiness in California.*

	March	April	May	June	July	Aug.	Sept	Oct.	Nov.	Average for 9 months
Red Bluff.	4.4	4.2	3.6	1.9	1.0	0.7	1,3	2 4	3.4	2 5
Sacramento	3.9	3.5	2.7	1.5	0.5	0.4	1.1	2.0	2.8	2.0
San Francisco.	4.8	4.3	4.2	3.8	4,3	4.8	3.5	3.3	3.8	4.0
Fresno	4.3	2.9	2.7	1.5	0.7	0.9	1.4	2.2	2.8	2.2
San Diego	4,8	4.4	5.3	4,8	4.3	3.9	3.7	3.8	3,3	4.3

TABLE III. — *Normal Cloudiness in Eastern United States.*

Mese	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Average for 9 months
Rochester, N. Y. . . .	6.6	5.4	5.2	4.9	4.6	4.6	4,9	6.0	7.6	5.5
New York, N. Y. . . .	5.5	5.3	5.2	4.9	5.0	4.9	4.7	4.9	5.2	5.1
Philadelphia, Pa. . . .	5.6	5,4	5.1	5.0	5.0	4.9	4,8	4.7	5.2	5.1
Baltimore, Md.	5.4	5.1	5.1	4.9	4.8	4.9	4.7	4.6	4.9	4.9
Cleveland, Ohio.. . . .	6.4	5.3	4,9	4.6	4.3	4.3	4.9	5.7	7.3	5.3
Grand Haven, Mich. . .	6,2	5.4	4.8	4.6	3.8	4.0	4.4	5.6	7.3	5.1
Jacksonville, Ha. . . .	4.2	4,1	4.1	5.1	4.8	4.9	5.0	4.2	4.5	4.5
New Orleans, La. . . .	4.8	4.8	4.3	4.7	4.9	4.7	4.3	3.5	4.5	4.5

It is noticeable that at the coastal points of California, the average cloudiness is almost twice that of the interior valleys, whilst in the east of the Rocky Mountains the opposite is evident, that is the interior regions of Western New York, Ohio, and Michigan have a greater cloudiness than the Hudson River, New Jersey and Delaware regions near the Atlantic sea board.

ATMOSPHERIC HUMIDITY. — Water vapour combined with high temperature favours the development of fungoid disease. But in California the percentage of humidity is high in the winter and low in the summer; on the east of the Rocky Mnts. conditions are reversed. It follows then that fungoid disease is rarer and less serious in California. The water vapour, however, absorbs a considerable amount of light and heat, both important in the ripening of fruit. Dry air is therefore more favourable to ripening.

TABLE IV. — *Normal relative humidity at certain Stations in California.*

	April	May	June	July	August	Sept.	October	Nov.	Average Apr.-Nov.
Los Angeles . . .	73.1	75.2	73.6	75.4	76.2	72.9	74.3	66.6	73.7
Fresno	59.3	52.7	42.4	34.7	34.7	43.6	55.1	64.1	48.3
Sacramento . . .	67.6	67.6	66.1	59.8	59.8	59.0	62.4	66.8	63.6
Red Bluff	61.9	56.8	43.7	35.6	35.3	43.6	51.6	60.7	48.6

An interesting comparison is made with the Eastern and Southern States where fruit cultivation in practised to the same extent.

TABLE V. — *Normal Relative Humidity in Eastern and Southern States.*

	April	May	June	July	August	Sept.	October	Nov.	Average April-Nov.
Jacksonville, Ha . .	72,3	73,0	77,6	78,6	80,9	82,9	79,8	82,2	78,4
Philadelphia, Pa . .	63,4	68,9	69,2	68,6	71,2	75,2	70,7	73,6	70,1
Rochester, N-Y . .	67,8	68,6	69,1	67,3	70,7	75,2	75,6	76,2	71,3
Grand Haven, Mich. .	70,9	71,4	73,7	69,0	73,1	75,0	75,7	79,1	73,5
St.-Louis, M.	63,7	67,8	68,8	66,3	67,3	70,2	65,9	71,1	67,6
New Orleans, La. . .	76,0	74,2	78,1	78,3	78,8	77,3	74,0	79,4	77,0
Galveston, Texas . .	84,6	78,0	79,0	77,4	78,1	77,2	75,6	80,4	78,8

In California, the constant high temperature, continuous sunshine and dry air, taken in connection with the soil fertility, and the length of season without frosts, ensures early and well formed fruits and abundant fruit crops from both trees and vines.

717 - **Effect of Temperature on the Geographical Distribution of Different Species of *Opuntia*.** — UPHOF, J. C. T., in *The Journal of Ecology*, Vol. VIII, No. 1, pp. 41-53 pl. 1, figs. 6. London, March, 1920.

The results of a study of the various degrees of resistance to cold of different species of cacti, growing in the desert of Arizona. The laboratory work was done in the Department of Botany of the University of Arizona, and the field observations were conducted in the deserts and mountain regions of Southern Arizona, especially in the vicinity of Tucson.

It appears evident that the geographical distribution and the height at which cacti being entirely adapted to a dry climate are found, is mainly dependent upon the resistance to cold of each particular species.

The vertical distribution of *Opuntia* spp. depends entirely upon the minimum temperature in winter. Some specimens taken from the desert and planted in the environs of Mount Lemmon (2790 m.), grew well in the summer, but succumbed in winter.

A comparison is made in the following table of the absolute minimum temperatures in and near this mountain group, 1913-14 :—

Elevation in metres	Absolute min. in winter °C.	Elevation in metres	Absolute min. in winter
723	— 2.2	2100	— 7.2
1200	— 3.8	2400	— 12.5
1500	— 5.0	2700	— 12.5
1800	— 5.6		

During the winter 1912-1913, the temperature at Tucson fell as low as — 14° C., and thousands of small plants of *Carnegia gigantea* were killed, whilst old plants with thick integuments (e. g. thick cuticle, crystal bearing layer and thick walled layer) were not damaged in the least.

The following experiment was performed : — Pieces of integument were dissected and wrapped carefully round the bulb of a thermometer, put into test tubes, the openings of which were closed with plugs of cotton. These were then placed in a glass cylinder filled with crushed ice, and in this way a temperature of 0° C. was easily reached. The rapidity of penetration of the cold is dependent upon the thickness of the integument, the specimens with the thicker cuticle obviously being more resistant to cold. The following table gives a summary of the experiments :

Name of plant	Thickness of cuticle μ	Thickness of crystal bearing layer μ	Thickness of thick-celled layer μ	Average time of penetration of 0° minutes
Opuntia fulgida	10–12	25–30	90–110	—
O. arizonica	12–18	20–25	95–120	—
O. Bigelowii	12–20	18–35	85–105	—
O. mamillata	15–20	15–25	90–115	—
O. castillae	15–20	30 42	100–120	63.3
O. sp. " Burbank special "	5–8	30–30	70–87	32.6
O. ficus indica (from Malta)	5–10	30–38	55–75	35.0
O. Ellisiana	12–15	25–25	75–130	79.3
O. fusicaulis	10–12	20–30	87–98	38.6
O. ficus indica (from Sicily)	12 15	30–40	62–74	40.6
Carnegiea gigantea	10–25	20–42	90–145	—
Echinocactus Wislizeni	10–20	25–35	90–120	—

Since the lowest winter temperatures in the desert are generally of short duration, a cactus plant having a thick integument may pass through such a period practically uninjured, even though the temperature may be low enough to be fatal to the protoplasm. A thick integument protects the plant against sudden and severe changes of temperature at any season.

At very high elevations, or in northern climates, where severe cold is of longer duration, the integuments even if thick are of no protection to sensitive plants, so that the geographical distribution of the species is in keeping with the capacity of the protoplasm to withstand certain low

temperatures. This quality, and also the fatal temperature, varies with particular species.

The following table shows the results obtained in the author's experiments:

	Temperatures		Difference in temperature	Temperature of Surrounding air
	Plant damaged	Plant skilled outright		
	°C	°C	°C	°C
Opuntia castillae	— 14°	— 17	3	— 20
O. sp. "Burbank special"	— 6	— 8	2	— 20
O. ficus indica, Malta	— 5	— 6	1	— 20
O. Ellisiana	— 16	— 18	2	— 20
O. fusicaulis	— 8	— 10	2	— 20
O. ficus indica, Sicily	— 5	— 8	3	— 20

The cold resisting quality of protoplasm is an hereditary physiological characteristic.

718 – **The Factors of "Light" and "Temperature" in Relation to Crop Production in Southern Italy.** — See No. 724 of this *Review*.

719 – **A New Variety of Asphodel Produced by the Action of the Marine Climate at Côtes-du-Nord, France.** — DANIEL, L., in *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 22, pp. 1332-1333. Paris, May 31, 1920.

The author has obtained remarkable modifications in *Asphodelus luteus* by growing it for 20 years in his garden at Erguy (Côtes-du-Nord), which is laid out on sand dunes covered with 80 cc. of transported vegetable mould. The original plants came from the Rennes Botanical Gardens.

The new type differs from the old one in its greener hue; its smaller, more numerous, and thicker set leaves with their very different structure; its thinner stalks; its branched, longer and looser inflorescences; later flowering; the shape and small size of its fruits and seeds; etc.

The new form retains its acquired characters whether propagated by cuttings or seeds. *A. luteus* is a southern plant, which so far as the author knows, has hitherto produced no new varieties when cultivated in gardens.

720 – **The Colloidal Function in the Soil and the Characteristics Depending Upon it.** — PRATOLONGO, U. (Laboratorio di Chimica Agraria della R. Scuola Sup. di Agricoltura di Milano), in *Stazioni Sperimentali Agrarie Italiane*, vol. LIII, Parts 1, 2 and 3, pp. 5-2, 2 diagrams, bibliography. Modena, 1920.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

The problem of the analytical determination of the sum of the colloidal constituents in the soil has arisen on account of the growing importance assigned to them. It will, however, remain entirely unsolved until the definition of the colloidal function upon which it necessarily depends is ascertained. Previous investigations by the author have shown that there is a simple proportion between the water content of the soil marked by VAN BEMMELEN's critical point (*écart critique*) in the vapour-tension curve, and the

amount of water present in the soil when the phenomena of wilting commence. Hence, it is of interest to determine the relations existing between this critical point and the data obtained by the physico-mechical analysis of the soil, using an easy and rapid method of determining the critical point. Having duly accomplished this, the author attempted to determine the effect produced upon the position of VAN BEMMELEN'S critical point of certain physical operations to which the soil is usually subjected. The experiments were made upon 12 soils, some coming from Argentina, and others from different parts of Italy.

The comparisons made between the data obtained by physico-mechanical soil analysis, whether carried out in the ordinary manner, or by the author's more accurate and complete densimetric method, and the results obtained by the above-mentioned method of investigation, revealed no relation of dependence upon the physico-mechanical constitution, as it is usually defined. On the other hand, the data furnished by this method, and taken as giving the colloidal content of the soil, clearly revealed a sensitivity to ordinary physical and chemical action (heating, freezing, etc.) which no other characteristic had hitherto attained ; these data thus represent, in an equally distinct manner, the variations, which from an agricultural point of view, are brought about on soils by this action.

The results obtained, and the deductions drawn from them, therefore, allow us to assign a scientific and practical value to VAN BEMMELEN'S critical point which has proved itself worth further study. The behaviour of the isotherm of vapour tension on the soil, which is a function of its colloidal content, is another soil characteristic that is important from the agricultural standpoint.

TILLAGE AND METHODS OF CULTIVATION

721 – **The Use of Explosives for Breaking Up the Land in the Province of Lecce, Italy** (1). — MANNARINI, A., in *I Campi*, Year III, No. 16, p. 2. Rome, April 18, 1920.

The results of some experiments on breaking up land by means of explosives in the Province of Lecce.

Mines with a charge of 300 gm. were drilled at a depth of 60 cm. in squares, 1.30 metres apart, in a heavy deep soil. The effect of the explosion of these mines was to break up the ground completely to the depth of from 80 to 90 cm. The radius affected, in the case of one isolated mine, was nearly 95 cm. In the central portion, the soil was reduced to small fragments ; towards the periphery, great clods were detached. At a distance exceeding 95 cm., there were many, deep, radial cracks in the ground with a maximum depth of 3 m.

In an experiment carried out at Ostuni, in compact calcareous soil, with a sub-soil of solid rock, a series of mines with a charge of 300 gm. was laid at a depth of 60 cm., the mines being 1.50 metres apart. The rock was entirely reduced to minute particles, and where the ground had offered greater resistance, there were deeper and more distinct radial cracks.

(1) See *R.*, 1911, Nos. 2259, 3135 ; 1912, Nos. 671, 777, 1398 ; 1913, No. 230 ; 1914, No. 1092 ;1917, Nos. 107, 1000 ; 1919, Nos. 19, 685, 821, 1091 ; 1920, No. 494. (*Ed.*)

The third experiment was made in shallow soil with a sub-soil of Lecce stone ; the holes were drilled 2 m. apart, and to a depth of 55 to 60 cm., the charges used being about 300 gm. The results of the explosion of an isolated mine were as follows : — For a radius of 40 cm. around the centre, the rock was blown to fragments ; between 40 and 90 cm. from the centre, there was a ring of shattered rock, great splinters and masses having been torn off ; beyond 90 cm., the rock was traversed in all directions by cracks splitting it up into polyhedric masses with sides from 15 to 20 cm. long. At a greater distance from the centre, large radial cracks appeared that were longer and wider than those produced in the other soils, perhaps because the rock was less hard. Where a series of mines had been exploded, although the interval between each was somewhat large, the rock was shattered, there being a quantity of minute fragments, few large blocks, and numerous cracks.

The fourth experiment was made on shallow soils with a tuff subsoil ; the results obtained were almost identical with those of the third experiment.

The cost of a charge of 300 gm. of explosive is in centimes, as follows : — Explosive 12 ; detonators 7 ; 1 m. fuse 7 ; priming 5 ; string and paper 5 ; total 36. This method would not be economical for hand-drilled mines. It would be necessary to use perforating machines, or mechanical drills capable of making 200 to 300 drills 70 cm. in depth daily. Landowners should form themselves into a *consortium* for the purchase and working of these machines.

722 – **Sulphuric Acid and Fertilisers.** — BAUMANN, in the *Chemiker Zeitung*, Year XLIV, No. 55, pp. 346-347. Köthen, May 6, 1920.

MANURES AND MANURING

The present scarcity of the raw materials required by the chemical industry naturally gives rise to restrictive measures, so that the riches of the soil have to be used with more foresight now, than before the war. A typical example of this is afforded by the sulphur and pyrites employed in the manufacture of sulphuric acid. The author has devoted his attention to the use of sulphuric acid in the production of the two main classes of chemical products, viz., phosphatic, and nitrigenous compounds. On the occasion of the celebration of the 25th. Anniversary of the Union of German Fertiliser Manufacturers, on Jan. 26, 1905, attention had already been called to the great problem, still unsolved, of the fertiliser industry and the dry treatment of phosphates without acids with a view to rendering them more available. Although the full economic importance of the question was not then realised, nevertheless experiments were undertaken for the purpose of partially, or wholly eliminating the use of sulphuric acid in the phosphatic fertiliser industry.

From the statistics on fertilisers published by the INTERNATIONAL INSTITUTE OF AGRICULTURE (1), it is possible to calculate the pre-war

(1) See : *World Production and Consumption of Chemical Fertilisers* : 2nd Edition 1914 — *International Trade* in Fertilisers and Other Chemical Products Used in Agriculture. Nos. 1 etc. Published by the International Institute of Agriculture. (*Ed.*)

consumption of sulphuric acid in the production of the above-mentioned class of fertilisers as follows:—

	Metric tons
World production of sulphuric acid	5 000 000
European » » »	3 700 000
World production of superphosphate	7 500 000
Corresponding world consumption of sulphuric acid	3 000 000
European production of superphosphate	5 600 000
Corresponding European consumption of sulphuric acid	2 240 000
World production of sulphate of ammonia	1 057 000
Corresponding world consumption of sulphuric acid	793 000
European production of sulphate of ammonia	941 000
Corresponding European consumption of sulphuric acid	710 000
Percentage of the world production of sulphuric acid used for superphosphate	60 %
Idem of the European consumption	65 %
Idem of the world production used for sulphate of ammonia	16 %
Idem of the European production	19 %

These figures show that $^3/_4$ of the world production of sulphuric acid is completely lost in the soil, when either superphospate or sulphate of ammonia are used, and at the present moment, we have no right to waste such an enormous quantity of sulphuric acid.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

723 - **The Composition of "Betratra" Cake Used as a Fertiliser.** — See No. 753 of this *Review*.

724 - **Biological Factors Affecting the Yield of Agricultural Crops in Southern Italy.** — RIVERA, V. (Memoria della R. Stazione di Patologia vegetale), in *Rivista di Biologia*, Vol. II, Part. II, pp. 22 Bibliography, 1 Plate, Rome, 1920.

In preceding articles, the author has briefly treated of the problem of the low yields produced by herbaceous crops in the southern regions of Italy (1). He now publishes the results of his recent investigations as to the influence of light and temperature in an environment like that prevailing in South Italy. As the data are based on laboratory experiments, they are not entirely applicable to ordinary field crops, but they prove that, while a high temperature produces an acceleration of growth, light has a very pronounced effect upon the accumulation of carbohydrates.

Of the two factors "intensity of light", and "duration of illumination," the second is the more important. It would even appear justifiable to state that, under natural conditions, excessive light does not promote the growth and activity of the green organs of many plants; on the contrary, the plant which grows both during the hours of sunlight and in darkness, regulates its development according to the number of hours of light it enjoys. The height, weight, and the amount of starch accumulated depend upon the number of hours of light, whereas the temperature influences the age of a plant. To be more definite the chief effect of a high temperature is to shorten the growth period, while longer illumination acts principally upon the formation of plant substance.

(1) See, *R.*, March, 1920, No. 304. (*Ed.*)

Productivity is thus closely connected with these two factors, the first (a very high temperature) shortening the period of photosynthetic activity, and the second (longer illumination) lengthening it. In a climate like that of southern Italy, both these factors concur in shortening the period during which photosynthesis can take place.

The problem of agricultural yield in southern Italy is principally a biological one, since the chief factors affecting the yield depend upon physical and meteorological causes, which if they produce a structure better suited to the environment, give rise to functional changes in the plant that are unfavourable to the production of heavy yields.

The cause of low yields must principally be sought for in the obstacles that the plant encounters during its life, and chiefly during the period that terminates its assimilating activity. The plant is a living laboratory, and the larger the total of work accomplished, the more it produces, accumulates, and increases in size. In the balancing of profit and loss that closes with the ripening the seed, the total results of the work which depend upon its intensity and duration are, when the accounts are made up, of the greatest importance. In the centre of southern Italy, intense work would, as a rule, be hindered by the brilliant light and high temperature, whilst the duration of the work is shorter owing to the longer nights. The working hours at the disposal of a plant growing in northern countries are usually much longer, although in these latitudes, the growth period tends to decrease. In the southern regions of Italy, the theoretical duration of the work, as far as it can be calculated from the hours of sunshine, is decreased by more frequent and longer periods of inactivity during the light. In regions of intense light and heat, the assimilation curve of wheat drops suddenly after midday. Whether this is directly due to too prolonged an exposure to intense light, or to an excessive acceleration of transpiration (though the plant protects itself against this by closing the ostioles of the stomata thus greatly reducing photosynthesis), or whether it is due to both these causes combined and also to the heat, it has the same effect, namely that for several hours of the day, in May and especially in June, no photosynthesis takes place. These hours must be regarded as representing the debit side of the plants budget, for what it loses by respiration is not balanced by a corresponding amount of assimilation, or by the absorption of sufficient food substances from the soil.

The injury caused by the dryness of the air or soil, when not such as to occasion the death of the tissues, is chiefly due to the same causes namely, the suppression of transpiration, and consequently the cessation of photosynthesis owing to the diminution, for a longer or shorter period, of the turgidity of the leaves. The fact that plants which have been liberally manured, especially with nitrogenous salts, or have been reared with copious supplies of water, wilt more easily, and thus produce lighter crops than unmanured plants in dry years, is also due the above-mentioned causes. This may be explained by the fact that the nutritive salts and the constant and abundant water supply produce tissues of less consistency and encourage a luxuriant development of leaf surface, thus increasing

transpiration and evaporation. The loss of water sustained in this way is not compensated for by a corresponding developement of the absorptive surfaces of the root.

While admitting a loss of profit due to this suspension of work, we do not in any way exclude the possibility that, owing to the suspension of the activity of the chlorophyll, it may produce indirect injury (scorching) to the general economy of the plant, especially at critical periods, such as flowering and setting. In this case, the suspension of assimilation becomes pathological, and the sign of a serious disorder affecting the most important functions of the plant's vegetative and reproductive life.

From what has already been said, it is clear that the problem of the low yield of wheat in southern Italy does not only depend on cultural, economic, and social factors, but also upon more or less serious functional disturbances of the photosynthetic activity of the plant ; therefore it ought first of all to be studied from the biological standpoint. The only means by which large yields can be obtained from these regions, even in the case of herbaceous crops, are the choice of the crops, combined with careful selection made with an eye to these difficulties, and the introduction of new species, or the creation of suitable varieties.

725 – **Observation on the Olive Flower in Italy.** — PIROTTA, R., in the *Atti della R. Accademia dei Lincei*, Fifth Series, Rendiconti, Classe di Scienze fisiche, matematiche e naturali, vol. XXVIII, 2nd. Series, Nos. 1-2, pp. 3-9. Rome, 1919.

As a result of repeated observation, the author is able to state, that the common olive tree (*Olea europaea*) bears 3 kinds of flowers : (1) Entirely monoclinal flowers with normal pistil and stamens producing fruit and seed ; (2) wholly polliniferous flowers ; (3) physiologically staminiferous flowers, that is, with normal pollen producing stamens, but with a pistil that has become abnormal by the greater or less reduction of the stigma and ovary. These three kinds of flower sometimes occur on different individuals, and there are olive-trees with monoclinal flowers (this is usually the case with cultivated trees, and those with staminiferous flowers (this type is the rarest among cultivated trees). Sometimes, on the same individual, two kinds of flowers are found, either monoclinal and physiologically staminiferous flowers, which often happens ; or monoclinal and staminiferous flowers, a much rarer occurrence.

The yield of the trees depends upon the character of its flowers ; those with monoclinal flowers are the most productive, whilst trees with monoclinal and physiologically staminiferous flowers are much less fruitful and their produce is often small, or of inferior quality, and those with little else but staminiferous flowers are almost sterile.

The staminiferous flowers of the olive, even when the pistil is much reduced, can easily be distinguished from the monoclinal kind, so that the tree bearing them, when it is in flower, differs in its whole general aspect. The inflorescences are longer, attaining ⅓ or ½, or even the total length, of the bract, whereas in the case of monoclinal flowers the inflorescences are short, and sometimes even so reduced as to be only ¼ of the

length of the bract. The inflorescences themselves are more ramified at the base, and therefore to some extent have the character of a cyme. The flowers are more numerous, the bud larger, whiter and spherical, and the fully opened flower is larger. The entire flower becomes detached and falls (whereas in monoclinal flowers, the corolla and stamens alone fall, the calyx and pistil remaining). The stamens are larger, and bear a greater quantity of yellow pollen; the pistil is either absent (the ovules also lacking) or is represented by a small central mucro.

726 – **On the Determination of the Poisonous Amanites by Means of Colour Reactions.** — BARLOT, J., in the *Comptes rendus de l'Académie des Sciences*, Vol. 170. No 11, pp. 679-851. Paris, March. 5, 1920.

I. — Amanites treated with 1 or 2 drops of aqueous solutions of bases or strong acids give a certain number of colour reactions which can be utilised in the determination of various species and, especially, to distinguish rapidly the most toxic species.

The 3 deadly poisonous Amanites react as follows :—

(1) *Amanita phalloides*, turns violet with ordinary sulphuric acid; the colour is particularly deep on the leaflets and under the epidermis. The author considers that the poison of the fungus takes part in this reaction. According to SELMI (*Sulle ptomaine od alcaloidi cadaverici*, Bologna, 1878), the ptomaines turn violet with sulphuric acid, if the acid is used carefully.

The other species studied gave the following shades with this reagent :.

Amanita pantherina : dark brown changing gradually to brownish-purple ;

Amanita citrina : greenish brown ;

Amanita muscaria : light brown at the edge of the lamellae ;

Amanita vaginata : pale brown ;

Amanita rubescens : loses its wine coloured appearance, and becomes discoloured or very pale brown.

(2) *Amanita pantherina*, with potash solution becomes vivid orange, especially at the base and edge of the lamellae. With this reagent, the other species give the following shades :

Amanita citrina : carmine brown no the edge of the hymenium ;

Amanita muscaria, *A. phalloides*, *A. rubescens*, *A. vaginata*. : nil.

(3) *Amanita citrina*, and its var. *mappa*, becomes at once intense deep greenish brown with nitric acid.

The other species give the following shades :

— *Amanita phalloides* : nothing at first, then a fairly deep yellow truit.

Amanita junquillea, *A. muscaria*, *A. spissa*, *A. rubescens*, *A. vaginata*, nil.

II. — In addition to these reactions, which enable each species to be distinguished, the 3 deadly poisonous Amanites may be distinguished by a commion haemoreaction.

A drop of fresh blood (the author used human blood and blood from sheep) is placed on the portions of periderm and stipe and potassium ferrocyanide is added. After a few minutes, *Amanita phalloides* and *Amanita pantherina* become black; this effect is also produced with *Amanita citrina*, but less intensely. Under similar conditions, the following species were not affected : — *Amanita caesarea*, *A. muscaria*, *A. vaginata*, *A. vaginata* var. *fulva*, and *A. strangulata*.

In the case of *Amanita rubescens*, the brown coloration due to the presence of an oxidase renders it very difficult to observe the shade.

III. — The author mentions the characteristic colour reaction of *Amanita junquillea*. This edible species is scarce, but easily confused with *Amanita citrina*. It turns instantly to yellowish brown, particularly just below the epidermis when a drop of ethyl chlorostannate dissolved in alcohol is applied.

None of the following species show this reaction : — *Amanita aspera*, *A. caesarea*, *A. citrina*, *A. muscaria*, *A. muscaria* var. *formosa*, *A. pantherina*, *A. phalloides*, *A. rubescens*, *A. solitaria*, *A. spissa*, *A. strangulata*, *A. vaginata*, and *A. vaginata* var. *fulva*.

727 – **Chemical Composition of the Australian Saltbush (*Atriplex semibaccata*,)** — See N. 749 of this *Review*.

728 — **The Effect of Drying on the Germination of Cereals.** — STAPLEDON, R. G. and ADAMS, M., in *The Journal of the Board of Agriculture*, Vol. XXVI, No. 4, pp. 364-381. London, July, 1919.

During experiments conducted at the Seed Testing Station the author obseved the effect on germination ot samples of wheat, barley, rye and oats : (1) Of drying the grain for 3 days at 40° C, and (2) keeping the grain without preliminary drying, for about 3 weeks compared with another part of the same sample whose germinating capacity had been determined when first received in the laboratory. The effect of drying was also observed on seeds that had already germinated or were germinating.

The results obtained are important both from the point of view of testing cereals und " conditioning " the grain (kiln-drying before storing the grain).

There is some risk in sowing the cereals early in the autumn immediately after thrashing. In such cases it is advisable with wheat, barley and rye to kiln or air-dry the grain ; black oats should be air-dried for 2 or 3 weeks.

The results of the germination test made before drying the sample under examination, or after keeping for some weeks, resembles much more the germinating capacity in the field than that resulting from the tests made after receiving the sample.

729 — **Formaldehyde Treatment of Maize Seed.** — RICHEY, F. D., in *The Journal of the American Society of Agronomy*, Vol. XII, No. 1, pp. 39-43. Washington, D. C., Jan., 1920.

The author observed the effect on the germination of maize seed, of treatment with formaldehyde solutions of different strengths and for different periods, with a view to preventing the growth of fungi on seedlings grown in water cultures. Samples were tested for germination both in water cultures and in sand. Treatment of maize with solutions of 5, 15 and 25 cc. of formaldehyde per litre materially reduced the development of the seedlings grown in water culture. The vitality of the seed, as evidenced by the development of the seedlings in either water culture or sand, was not affected by treatment with a solution of 5 cc. of formaldehyde per litre. Treatment with the solution of 15 cc. off ormaldehyde per litre did not

materially affect the seedlings grown in water culture, but nevertheless was injurious to germination and development in sand. Treatment with 25 cc. per litre was markedly injurious. Soaking maize for 2 hours in a solution of 5 cc. formaldehyde in 995 cc. of water, followed by a fumigation period from 2 to 24 hours in length, can therefore be recommended for checking the development of fungi, without interfering with the normal development of seedlings in water cultures.

730 – **Germination of Seed of *Tilia, Sambucus* and *Rubus*.** — ROSE, R. C., in *The Botanical Gazette*, Vol. LXVII, No. 4, pp. 281-308, bibliogr. of 25 works. Chicago, Illinois, April, 1919.

The author attempted to determine the conditions favouring the afterripening and germination of the seeds of *Tilia americana*, *Sambucus canadensis*, and *Rubus Idaeus*, and some of the chemical processes involved therein. Air-dried seeds planted in the soil over winter give a low percentage of germination, and do not germinate if placed on a moist substratum at room temperature. Water absorption does not therefore seem to be the limiting factor for seed germination.

731 – **Response of Citrus Seedlings in Water Cultures to Salts and Organic Extracts.** — BREAZEALE, J. F., in the *Journal of Agricultural Research*, Vol. XVIII, No. 5, pp. 267-274, pl. 2. Washington, D. C., Dec. 1, 1919.

The experiments described were carried out mainly at Riverside, California, in connection with other investigations relating to the causes of the malnutrition of citrus plants. Lemon, grapefruit and several varieties of orange seedlings were grown in water cultures, to which was added solutions of various salts or organic matter.

Seedlings of various citrus stocks showed no characteristic differences in response to water cultures or in resistance to toxic solutions.

Very dilute extracts of organic matter from upland peat (10 parts per million or more) produced a marked stimulative effect on the root growth of citrus seedlings. Corresponding concentrations of sodium nitrate or potassium chloride did not stimulate the root development. Calcium carbonate stimulated the root growth and exerted a pronounced antagonistic action to toxic solutions of nitrates and ammonium sulphate. Peat extracts in very dilute concentration (20 parts per million), and calcium carbonate, both protected citrus seedlings to a marked degree against the toxins of distilled water.

The tolerance of citrus seedlings to alkaline salts is relatively high. The toxic limit for calcium hydrate was 100 to 120 parts per million, for sodium hydrate 250 to 300 parts per million, and for sodium carbonate 550 to 600 parts per million. When soluble organic matter (which is acid in reaction, and stimulating to citrus seedlings) in concentrations of 1000 parts per million or more, is added to a sodium carbonate solution of 400 parts per million, which in itself is toxic, a highly toxic solution is formed which kills the root tips of citrus seedlings. This reaction appears to be of practical importance in connection with the toxicity of soils containing small amounts of sodium carbonate.

PLANT BREEDING

732 - **The "Ardito" Wheat, Obtained by Hybridisation, in Italy.** — STRAMPELLI N., in *L'Italia agricola*, Year 57, No. 6, p. 177, 1 pl. Piacenza, June 15, 1920.

This new variety of wheat was obtained by the author at the Cereal Experiment Station at Rieti. It was derived from the cross Tarwe × Rieti which gives an excellent yield but ripens exceedingly late, after hybridisation with the a Japanese wheat « Akagomughi », of no cultural value, but very early. It has the following characters :

Ears red, with an average density of 26, and a number of fertile spikelets varying between a minimum of 18 and a maximum of 22 (average 20)

Spikelets bearing 4 to 5 fertile flowers ; the average number of caryopses per ear is 65 to 70, with a maximum of 75 and a minimum of 50.

Glumes oval, with pronounced keel with a red tip, principal vein and secondary veins, with reddish brown edges.

Palea, oval, lanceolate, edge reddish brown, beards of varying lengths increasing in size from the bottom of the ear (3, 5, 10, 15 mm.) to the tip, (45 or 50 mm).

Caryopses, fine reddish colour, varying in size and shape according to their position on the ear, but inclined to be oval and slightly inflated, lobes round in section, and concave ventrally. Average length 6.3 mm, average breadth to 3.3 mm, dorso-ventral diameter 2.8 to 3 mm.

Endosperm starchy. Weight of 1000 grains 35. 40 gm, weight per hectolitre 79 kg.

Stalks strong, barely 80 cm. in height.

Maturity very early ; in 1917, harvested on June 17 ; in 1918 (sown on the hillside, southern exposure, clay soil), harvested on June 8 ; in 1919, cultivated on the cool plains, it was ripe on June 30, whilst Rieti, could not be harvested before July 15.

Yield. The last crop gave more than 24.49 cwt. per acre. This wheat must be sown somewhat thickly.

733 - **The Production of Wheat for the Highlands of British East Africa by Hybridisation and Selection.** — DOWSON, W. J., in *Bulletin No. 4, Department of Agriculture Nairobi, British East Africa*, pp. 1-16. Nairobi, 1919.

The principal object in selection consists in the production of a strain of wheat with a good yield and at the same time resistant to various rust fungi (black stem rust = *Puccinia Graminis*; yellow rust *P. glumarium* ; brown or leaf rust *P. triticina.*)

The most promising variety from the point of view of resistance to rust, found on Lord Delameres estate, was the Italian wheat Rieti, and this subsequently constituted one of the parents for hybridisation experiments later on.

In 1910-12, both at the Government Experimental Farm, Kabete, near Nairobi and also at Lord Delamere's estate, the following crosses were made :

No. 1, Rieti × Bobs (Australian).
No. 2, Rieti × Gluyas (»).
No. 3, Rieti × Australian

No. 4, Rieti × Thew (Australian).
No. 5, Egyptian No. 3 × Thew.
No. 6, » No. 1 × »
No. 7, » No. 4 × »
No. 8, » No. 2 × »
No. 9, Rieti × Federation.
No. 10, Early Rieti × Thew.

Rieti wheat was selected because of its resistance to all the forms of rust. It was also discovered that the Egyptian wheats exhibited a high resistance to *Puccinia Graminis* but were occasionally susceptible to *P. glumarum*.

The other parents, although not be relied upon to withstand rust, possessed on the other hand further outstanding qualities such as good quality grain, stiff straw, beardless ears, etc.

During the season January to February 1911, the following crosses were made at Kabete:

No. 11, Rieti × Red Fife:
No. 12, Egyptian No. 3 × Yellow Fife.
No. 13, » No. 3 × Nut Cut (Australian).
No. 14, » No. 3 × Moulds.
No. 15, » No. 3 × Thew.
No. 16, » No. 4 × Thew.
No. 17, Early Rieti × Moulds.
No. 18, Early Rieti × Chinese White.
No. 19, Red Fife × Golden Ball.
No. 20, Early Rieti × Bobs.

The results obtained were encouraging and justify better hope for the future. Even now this work demands a special officer, who shall devote his whole time to the problem of plant breeding in general, in addition to experimental work with wheat.

A recent cross between the Canadian wheat Marquis and one of the best selections of the cross No. 11 (Rieti × Red Fife) gives very promising results.

Of the 20 and more hybrids originally created, only some 5 or 6 have proved really resistant to rust, and at the same time fair croppers of good milling grain.

The following is a list of selections from the most satisfactory hybrids thus obtained:

1) Selections from hybrid No. 4 (Rieti × Thew).
2) » » » No. 10 (Early Rieti × Thew).
3) » » » No. 11 (Rieti × Red Fife).
4) » » » No. 12 (Egyptian No. 3 × Yellow Fife).
5) » » » No. 13 (Egyptian No. 3 × Nut Cut).

Some of these hybrids have already been grown on a large scale and with success in a considerable number of districts: Machakos (Athi River) Nyeri, Thika, Nairobi, Nakuru, Molo, Uasin Gishu and Trans-Nzoia.

734 – **Inheritance of Waxy Endosperm Aleurone Colour, and the Correlation between Endosperm Texture and Aleurone Colour of Maize.** — KEMPTON, J. H., in the *U. S. Department of Agriculture Bulletin of Plant Industry, Bulletin* No. 754, pp. 1-9, figs. 14, bibliogr. of 16 works. Washington, D. C., June 26, 1919.

In 1908 Mr. G. G. COLLINS found in a variety of maize imported from China, a new type of endosperm which was entirely different from any others previously known.

The 3 types already recognised are horny, starchy, and sweet. The cut surface of the endosperm of the Chinese variety resembled a hard wax, and the texture was therefore designated cereous (waxy).

This waxy endosperm was found to be alternative to horny endosperm, behaving as a definite recessive character, no blending or intermediate stages having been found, which simplifies the observations and studies on inheritance and the behaviour of Mendelian characters.

This bulletin reports the results of a series of investigations on ; (1) The inheritance of waxy endosperm ; (2) the inheritance of aleurone colour ; (3) the correlation between endosperm texture and aleurone ; (4) the correlation between endosperm texture and aleurone colour. Crosses were made between the waxy maize and an Algerian variety of maize with a horny endosperm.

INHERITANCE OF WAXY ENDOSPERM. — In 1911, crosses were made between the Algerian var (horny) ♀ × Chinese var. (waxy) ♂ giving the hybrid Dh 237, and between the Chinese var. (waxy) ♀ × Algerian var. (horny) ♂, giving the hybrid Dh 234.

In each case, in the F_1 it was evident that the horny character was dominant. The F_2, resulted in a monohybrid, in the ratio horny : waxy = 3 : 1. A fact of considerable importance should be observed, namely, that the deficiency in the waxy character, although negligible is constant, and could not be considered as due to chance or to calculative error. In the F_2, for example, instead of 25 % with waxy endosperm, the mean percentage for F_1 and F_2 is 23.9, showing a deviation of 1.1 %.

The reciprocal crosses clearly indicated that, in some cases, the percentage of male gametes bearing the waxy character was below that expected. It has not been possible so far to determine whether this observed deficiency is due to a higher death rate, reduced vigour, or a failure of equal segregation.

INHERITANCE OF ALEURONE COLOUR. — The Chinese variety possesses white aleurone, and the African variety coloured aleurone. Two and possibly more factors are concerned in the production of the latter character. The percentage of white seeds obtained in the F_2 of the hybrid Dh 234 showed that the aleurone colour of this hybrid behaved as a unit character ; approximating 25 % white. The F_2 of hybrid Dh 237 on the contrary, fell into two individual groups ; approximately half the plants having a monohybrid and the other half a dihybrid ratio.

To explain these phenomena, it is necessary to assume that aleurone colour is the result of 2 factors, which may be designated by the letters C and R. In the first cross (Dh 237), the Chinese parent had the gametic

combination **cR cR** and the African **CR CR.** When **cR**♂ fertilised **CR**♀, a coloured seed would result, and this when sown would produce the gametes **CR** and **cR**, which would give a ratio of 3 coloured to 1 white when self-pollinated. If, however, **cR**♂ is fertilised with **Cr**♀, a coloured seed would result, which when sown would produce 4 kinds of gametes, viz.; **CR**, **Cr**, **cR**, **cr**, and these when self-pollinated would result in 16 different combinations in a dihybrid ratio of 9 coloured to 7 white.

In the second cross (Dh 234) it is assumed that the Chinese parent had the gametic composition of **Cr Cr**, and the African **CR CR.** When **CR**♂ fertilised **CR**♀, a couloured seed would result, which when planted would produce the gametes **CR** and **Cr**, resulting 3 coloured to 1 white. There was deviation from this rule: F_2 gives in every case the monohybrid ratio.

An F_1 plant of the hybrd Dh 237 was pollinated with the Chinese variety, and the resulting ear had 54.17 % white, while another ear of the Dh 237 plant when self pollinated gave 25.2 % white seeds. Assuming that Dh 237 (segregating 3 coloured to 1 white) has the composition **CR cR**, a Chinese plant producing only **c R** gametes would be expected to give 50 % white when crossed with Dh 237.

The hybrid Dh 237 (**CR cR**) when self-pollinated, would give theoretically 25 % white seed (25.2 % was observed).

The Chinese hybrid (**cR**♀) would give theoretically 50 % white seed (54.17 was observed).

The white seed can therefore be classified theoretically according to the percentages, 25, 43, 75 and 50; but in reality deviations are not only constant, but although small, always, in excess of the probable error which excludes the possibility of attributing them to chance.

The 163 ears had a total of 81 366 seeds with 25 % white instead of 25.5 %; the difference of 0.5 % being given the number of the seeds involved, is almost 5 times the probable error.

For 110 ears with 47 872 seeds, 49.2 % were white instead of the expected 50 %. The deviation of 8 % is 5.10 times the probable error.

For 15 ears with 6519 seeds with 43 % white, there was a deviation of 0.75 % from the expected percentage.

The experiments confirm results previously obtained concerning the aleurone colour special. Attention should be drawn, however, to the deviation of the percentages of white seed, deviations which undonbtedly exist and which cannot be attributed to chance.

CORRELATION BETWEEN ENDOSPERM TEXTURE AND ALEURONE COLOUR. — Taking the symbol **H** for horny endosperm texture, and **h** for the waxy texture. The results of a series of analyses dealing with 17 15 seeds has led the author to discover that a correlation exists between the factor **C** (colour : see preceding paragraph) and the factor **H.** This degree of correlation has been found to be 0.762 ± 0.0057, and this may be explained by admitting that the gametes **CH** and **Ch**, instead of giving equal numbers, gave a ratio of 3 :1.

735 – **Selection of Strains of Dent Maize, Considering both Yield and Maturity, Adapted to New York State Conditions.** — MYERS, G. H., in the *Journal of the American Society Agronomy*, Vol. XII, No. 3, pp. 106-112. Washington, D. C., March, 1920.

The selection of dent maize was begun for the purpose of obtaining strains better adapted to the State of New York conditions, taking into account the qualities of yield and maturity, owing to the comparatively short growing season free from frost.

The experiments were carried out at Saratoga at an elevation of 400 ft. Here the growing season has an average length of 154 days, and the average date of the last spring frost falls on May 6, and the average date of the first autumn frost on October 7. Only the early strains of flint maize could be matured in this district in normal seasons.

Selection was made by the ear-to-row method, the seed from one ear being sown in a single row. The yielding capacity and maturity was determined for each row.

1) YIELD. — The total yield per row, as well as the individual yielding capacity were recorded. The latter was obtained by dividing the total weight in each row by the total number of eared stalks.

2) MATURITY. — At the beginning of the harvest season and at the end of the growing season, the ears were divided into two lots, ripe and unripe. The number of ripe ears was divided by the total number of ears, to give the expression which is called the "percentage of maturity."

Having determined the yield and the maturity, it was thought desirable to combine both of these expressions into a single one which should serve as a basis for selection. The author multiplied the average yield per plant by the percentage of maturity. This gave the "selection coefficient." Using the yield per row instead of the average yield per plant gave another coefficient, and this was not markedly different from the first.

The higher the selection coefficient, the greater will be the value of the corresponding line. In 1909, data from 50 rows were obtained showing a variation in the value of the selection coefficient ranging from 0.008 to 0.494.

From each row, 6 to 10 seed ears were reserved for further examination.

The following data from the comparison plot in 1911 and dealing with both selected and original seed from Illinois, are given :

Table I shows the results of 3 years' selection. The difference as shown by the yield is not striking, the average for the selected seed being 0.621 lb., while that for the original in 0.650 lb. With regard, however, to the percentage of maturity, there is a marked difference in favour of selected seed, for which the average is 71.9 while that for the original is only 13.2.

It has been found possible, therefore, to obtain a strain of dent maize which gives a good yield, and at the same time ripens sufficiently early to respond to the climatic exigences in New York State, with better success than the original variety.

TABLE I.

Row No.	Selected Seed: Yeld per stalk	Selected Seed: Percentage of maturity	Selected Seed: Selection coefficient	Row No.	Original Seed: Yield per stalk	Original Seed: Percentage of maturity	Original Seed: Selection coefficient
11	0.673	66.7	0.449	12	0.643	21.6	0.139
13	0.656	73.2	0.480	14	0.708	4.8	0.034
15	0.690	77.5	0.535	16	0.738	12.8	0.094
17	0.640	73.2	0.468	18	0.677	9.7	0.066
19	0.690	77.3	0.533	20	0.670	13.2	0.088
11^a	0.649	65.2	0.423	12^a	0.655	29.7	0.194
13^a	0.560	71.4	0.400	14^a	0.633	17.8	0.113
15^a	0.490	69.2	0.339	16^a	0.602	6.7	0.040
17^a	0.565	67.5	0.381	18^a	0.583	10.8	0.063
19^a	0.600	77.5	0.465	20^a	0.594	5.1	0.030

736 – **Inheritable Characters of Maize: Pistillate Flowered Maize Plants.** — EMERSON, R. A. (New York State College of Agriculture), in *The Journal of Heredity*, Vol. XI, No. 2, pp. 65-76, figs. 8. Washington, D. C., Feb., 1920.

At the annual "Corn Show" held at Lincoln, Nebraska, in the winter of 1913-14, a maize plant was exhibited which had an inflorescence in the form of a tassel, but bore a heavy crop of seed like a sorghum panicle:

The seeds of this specimen were sown at the Nebraska Experiment Station in the spring of 1914. All the resulting plants were normal, which may be attributed to the fact that pollen was not obtained from abnormal plants and to the recessive character of the pistillate inflorescence. One of the plants was self-pollinated and the progeny grown at Ithaca, N. Y., in 1915 consisted of both normal and abnormal plants. The normal plants were typical representatives of the rather late white dent variety cultivated in the Middle West.

The abnormality is known as "tassel seed," and, apart from the arrangement of the seeds, the inflorescence resembles in appearance the normal male terminal inflorescences.

The "tassel seed" is designated by the symbol **ts**, its dominant normal allelmorph being **Ts**.

In 1914, several plants of the variety "Pride of the North" were self-pollinated, and one of these gave progeny consisting of both normal and abnormal plants, the latter having pistillate-flowered tassels. In this case, also similar to the preceding one, the abnormality is inherited as a recessive.

The abnormality of Pride of the North is called "tassel ear" because of the ear-like form of the tassel, and is designated by the genetic symbol **te**, the dominant allelmorph being **Te**.

These two examples, although apparently identical, are as will be seen later, extremely divergent in character.

The F_2 progenies of the tassel-seed specimen gave a total of 238 normal to 67 abnormal, which corresponds with the mendelian monohybrid

ratio 3 : 1. When F_1 individuals were crossed with the abnormal parent there resulted 368 normal and 381 abnormal (1 : 1). It is evident that the two types differentiated from normal by the single factor pair : **Ts ts**.

Tassel-ear plants crossed with normals gave 24 normal plants in F_1, and 260 normal to 36 abnormal in F_2. This is too great a deviation from a 3 : 1 ratio to be due to chance. The possibility is at once suggested that the two types differ by one factor pair, and in others by two pairs hence the 15 : 1 ratio. But the calculated numbers, should be 277.5 normal and 18.5 abnormal. Even such a deviation as this would very rarely occur by chance.

The author, after having obtained analytical data for numerous progeny, both in F_2 and F_3, returns to the theory of the 3 : 1 ratio, suggesting that the observed deficiences in the abnormal plants are probably due to the low germinating capacity of the seed, the general lack of vigour displayed, and the consequent failure of the abnormal plants to survive and become differentiated.

It has been stated above that tassel seed and tassel ear were at first supposed to be identical. But, if the two types were fundamentally identical, differing only in density of inflorescence, vigour of growth, etc., crosses between the two should give pistillate-flowered plants. This cross is of course impossible, owing to lack of pollen.

Conclusive evidence can, however, be obtained from crosses of normal plants, the one heterozygous for tassel seed and the other heterozygous for tassel ear.

If the two recessive types were the same, the cross of two heterozygotes should give 25 % of pistillate flowered plants in the progeny. But 69 normal plants were produced by the cross. The two pistillate-flowered types are therefore genetically distinct. What the double recessive will be like cannot be decided until another generation is evolved.

The two abnormalities show interesting linkage relations with certain other factors of the maize plant.

A back cross involving tassel seed, **Ts ts** (normal heterozygote of F_1) and a factor pair for pericarp colour, **Pp**, gave 81 normal plants, *all with red pericarp*, and 77 tassel seed plants *all with colourless pericarp*.

The colourless pericarp and the tassel seed characters will then, be linked, that is, connected with the same chromosome, and the normal and red pericarp characters will be united in a similar way.

In a similar back cross, but involving a tassel ear **Te te**, there appeared normals with red and colourless pericarp and tassel ears also with red and colourless pericarp. There were 50 plants of the parental combination, i. e., tassel ears with colourless pericarp and normal ears with red pericarp, and 56 of the other two combinations, i. e., tassel ears with red pericarp and normal ears, with colourless pericarp.

There is therefore a distinct difference in these two cases between the linkage relations. In the second case, according to the "crossing over" hypothesis (the exchange of characters between two paired chromosomes) the cross-over percentage will be 52.8 %. Apparently then in

more than 50 % of the cases, half of the chromosome possessing the character tassel ear, becomes detached and unites with half of the other chromosome possessing the red pericarp factor. It is known that a recessive leaf abnormality called "liguleless" (**Lg lg**) is linked with a dominant plant colour called sun-red, in which the factor pair **Bb** is involved.

A back cross involving **Bb**, **Lg lg** and tassel ear (**Te te**) produced 96 plants with 6 to 8 possible combinations of these 3 pairs of factors. The cross-over percentage for **Bb** and **Lg lg** was 29.2 for **Bb** and **Te te** 20.8, and for **Lg lg** and **Te te** 45,8. In this last case, the percentage is so near 50 that, standing alone it affords no satisfactory evidence of linkage between the two characters "tassel-ear" and "liguleless."

The numbers of all the several classes were very close to expectation on the basis of the cross-over percentage observed. Of the 96 plants, 50 were non-cross-overs, 44 single cross-overs and 2 double cross-overs.

There are no data available at present with respect to the possible relations between **Ts ts**, **Bb** and **Lg lg**.

What would be the appearance of a plant with the double recessive tassel ear, and tassel seed is not yet known. However, the known linkage with other characters should make the solution of the problem less difficult. By introducing both **Pp** and **Bb** into the cross of tassel seed and tassel ear : (1) Any resulting pistillate flowered plant with colourless pericarp is almost certain to be **ts ts**, and (2) any pistillate flowered plant having the factor of the pair **Bb** present in the tassel ear parent of the tassel seed tassel ear cross will, 4 times out of 5, be **te te**.

737 – **Pure Line Selections of Rice in Burma.** — *The Tropical Agriculturist*, Vol. LIV, No. 3, pp. 133. Peradeniya, Ceylon, March, 1920.

Varietal selections of rice are being continued and "kalagyi" a strain improved at Mandalay has been tried at Hopin with good results.

At Yawnghwe the native varieties have been examined, and 3 selections made, and these are being multiplied for distribution.

The variety Ngasein 2104 continues to be a favourite with cultivators, especially in the Kyankse district where the area covered is gradually extending.

In the Southern Circle the pure strains Ngasein 8, Ngasein 10, Ngachima and Letywezin continue to hold their position.

Ngasein 10 as a heavy cropper is the premier variety and in spite of the fact that the season was unfavourable the yield was 3084 lb. per acre on an area of 22.74 acres.

738 – **A Mutating Blackberry-Dewberry Hybrid *Rubus caesius* × *R. fructicosus*.** — DETJEN, L. R., in *The Journal of Heredity*, Vol. XI, No. 2, pp. 92-94. Washington Feb., 1920.

The hybrid *Rubus caesius* × *R. fruticosus* (*lacinatus* Wild.) is very common in the vicinity of Raleigh, N. C. In the summer of 1915, the author discovered a specimen with a two canes, one normal, i.e., with entire leaflets, and one abnormal, i. e., with finely divided leaflets. The latter crown was taken up and planted in the station experimental vineyard.

By means of tip-layering, two distinct plants were secured, which continued to reproduce themselves, conserving the characteristics of the original mutation. In 1919 amongst the progeny, cases of atavism were noticed consisting of a complete or partial reversion of the leaflets to the undivided form.

739 – **Natural Selection of *Asphodelus Luteus* Effected by the Marine Climate on the North Coast of France.** — See No. 719 of this *Review*.

AGRICULTURAL SEEDS

740 – **Distribution of Seeds for Sowing in France.** — HITIER, H., and J., in *L'Expansion Economique*, Year III, No. 8, pp. 13-14. Paris, 1919.

The export of French seed, which has more than doubled in quantity within 50 years from 1880 to 1913, represented before the war a value of 50 million francs.

At the head of the list of these export comes the leguminous seeds: alfalfas and clovers. In France there are two principal centres for the production of these seeds, i. e., Provence and Poitou situated on very fertile soil, where alfalafa seed is produced which is universally sought after throughout the world. In Poitou and in Brittany, clover seed is produced in large quantities.

Saint-Remy, in Provence, is one of the most important districts for the production of seeds of vegetables, such as beets carrots, celery cabbages, cucumbers, spinach, broad beans, kidney beans, lettuce, and onions. The principal seed warehouses, not only in France, but also in England, Russia, Denmark, Holland, the United States, and before the war Austria and Germany, arrange with the farmers at Saint-Rémy and in its vicinity to propagate a certain quantity of the best seeds from these plants.

It is the same in the Loire valley, between Saumur and Angers, where the cultivation for seed has developed considerably within the last 40 years. The farmers in this valley have found their soils to be an especially suitable medium for seeds. The better known seeds merchants in Paris have special seed plots there, which are superintended and worked by their agents, who visit frequently and have charge of the selection and cleaning of the produce. The principal crops included are : Cabbages, carrots, lettuce, beets, chicory, cucumbers, celery, kidney beans, turnips, leeks, sorrel, parsnips, parsley, pumpkins, radish, salsify, etc. Mignonettes, balsams, wallflowers, everlasting flowers, pansies, carnations, pinks, amaranths, etc., are also cultivated for seed purposes.

Even with the greatest care on the part of certain establishments and certain farmers, before the war, the production of beet seed was insufficient to meet French requirements, and permit of extensive exportation. But, since the war, in various parts of France, the crops have been increased and the most careful and perfected methods of selection used. Moreover, for some years now, in the experiment stations organised by the French syndicate of sugar manufacture, French seed carefully compared with German seed, has given excellent results, both in size of root and in sugar yield per hectare.

After the war the French production of beet seed should be able to cope with the demand both in France and abroad. In 1918, a Syndicate of French Beet Seedsmen was established. This Syndicate does not intend only to support the corporate interests of the profession, and to investigate and improve the beet seed, but also to see that the seed sold under cover of the Syndical Chamber, responds to certain guarantees. This is a commercial organisation which resembles the "douze marques" flour market. The syndicate sets a guarantee mark on the roots produced by each of its members, these agreeing in advance to submit mutually to this strict method of control.

CEREALS AND PULSE CROPS

741 – **Topping of Wheat Liable to Lodging.** — I. SCHRIBAUX, H. BACHELIER, in *Comptes rendus de l'Académie d'Agriculture de France*. Vol. VI, No. 14, pp. 360-365. Paris, April 14, 1920.

I. — M. SCHRIBAUX describes a definite means, not only of dealing with lodging, but for utilising the vigour of growth of wheat to increase the grain yield at the expense of the straw yield.

When the wheat shows signs of bearing and measures about 30 cm, it is sufficient to cut back to 15 cm, i. e., to half its normal height. When the plant again reaches a height of 20 cm., it is advisable to cut back a second time to 15 cm. if it still appears liable to lodging; this second treatment is hardly ever necessary. By this means, the entire wheat crop is rendered resistant to lodging, whatever the height, and 30 and 15 cm., are the recognised figures which it is wise to observe as nearly as possible. If the wheat obviously exceeded 20 cm. in height, one must take the risk of topping, anyhow to a small extent, the young ears, which are still enclosed in the sheath.

The practice of topping, first pointed out by M. HANICOTTE, farmer and former President of the Syndicate of Agricultural Distillers in the North, is at the present time a generally recognised procedure on the best farms in the north of France. On small areas, the wheat is cut with the scythe or sickle; in the neighbourhood of Paris, a header is employed, which is a kind of very light sickle with a blade which can be lifted to at least 15 cm. This same implement, manufactured by GARNIER, at Mormant (Seine-et-Marne), is also used for destroying weeds amongst the wheat.

Topping delays ripening for some days and somewhat reduces the straw yield, but, on the other hand, the quantity and quality of the grain yield is improved. A field thus treated gave the lowest proportion of dwarfed wheat. The cause is easily explicable: The topping which can be compared to the pinching practised by gardeners has the effect of equalising the development of the tillers. The more advanced are retarded in growth to the advantage of the smaller ones, not reached with the sickle; the latter which would have only given small tiller growths, take the same time to mature as the older ones.

In order to show the various advantages of topping, M. SCHRIBAUX gives a brief *résumé* of a paper read some time ago (1909) before

the National Agricultural society, by M. BACHELIER. M. BACHELIER had cut back wheat covering an area of 61.75 acres sown after alfalfa, leaving a control plot of 32.8 ft. untouched for comparison purposes. In the area treated, M. BACHELIER obtained an increased yield of 633 kg. of grain and a decreased yield of 700 kg. of straw per hectare.

What expenses are entailed by this operation? The machine used cost 450 fr. (pre-war prices). The cost of upkeep is negligible, as the blade is held too far away from the soil to encounter obstacles, (14 fr. for upkeep in 7 years. An area of 9.8 acres, can be covered in a day by a man and a horse. The cost per acre may be estimated thus:

Manual labour and horse	1.00 fr.
Depreciation and upkeep of machine	0.60 »
	1.60 fr.

This expense, plus the value of at least 13.7 cwt. of hay, is largely compensated for by the decrease in the cost of harvesting and the superior quality of the produce.

The idea of topping is almost as old as the cultivation of wheat, but M. HANICOTTE has the merit for having perfected it.

This method is equally successful with oats but the operation is not so easy as with wheat. As oats grow very quickly, the time allowed for performing this operation is very limited. By delaying the treatment there is a risk of a letting the plant get too tall, and of injuring the panicle, still enclosed in the sheath, and consequently of damaging the production of grain.

II. — M. BACHELIER considers that there is no reason to fear that, even in case of drought, topping will damage the crop yield.

In order to apply this process to hardy wheats, it is absolutely necessary to choose the right moment when the upper part of the leaves can be clipped without touching the stalk. The whole success of the operation depends on this precaution.

With the GARNIER, it is possible to cut back 9.8 acres per day. The machine consists of a kind of shears with a detachable blade which can be regulated to the height of the wheat. This blade is lighter than that of a mower. It is necessary to work quickly, as the period when it is possible to cut back wheat is very limited. Topping slightly reduces the height of the stalks and makes the plant resistant to lodging.

742 - **Phosphatic Fertilisers as a Means of Hastening the Maturity of Maize.** — RAYMOND, L. C., HARCOURT, R. and ELLIS, J. H., in *The Agricultural Gazette of Canada, Department of Agriculture, Ottawa, Canada*, Vol. 6, No. 6, pp. 550-552. June, 1919.

It is well known that phosphates are particularly valuable in inducing root development, and that later in the life of the plant the ripening processes are hastened by them. This has already been demonstrated in England, by Dr. F. J. RUSSEL, at the Rothamsted Experiment Station dealing with crops in general; in the United States by Prof. L. H. SMITH Agronomy department, Illinois; by Prof. G.E. CORSON, Iowa College

Station ; by Prof. J. D. HARPER at Indiana, and by Prof. R. A. MOORE, University of Wisconsin, with maize.

The stimulative action of phosphates on ripening, has the same effect as a deficiency of water, but to a minor degree ; nevertheless, as maize is deep rooted, there is not the same danger as with other crops (for example barley), that in case of drought the use of phosphatic fertilisers may add to detrimental effects of lack of water. It seems safe to conclude that this fertiliser will give invaluable aid in extending the northern limits of the maize area, both for grain and silage purposes, owing to its ripening effect on the crops. In Ontario, Mr. R. HARCOURT has noticed that the use of phosphatic fertiliser brought the maize to a stage of maturity a week in advance of the usual time. Further investigations will be necessary before it will be possible to ascertain to what extent phosphatic fertilisers may be used to hasten the maturity of various varieties in different localities.

743 – **Note on the Cultivation of Floating Rice in Cochin-China.** — TRAN-VAN-UN (Assistant at the Laboratory of Genetics of the Scientific Institute of Indo-China), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 2, pp. 46-52. Saïgon, February, 1920.

The botanical name of floating rice is *Oryza Sativa* L. var. *utilissima* Kches, var. *mutica*(1) according to PIERRE or *O. Sativa* L. and var. *fluitans* according to CREVOST and LEMARIE.

CENTRES OF CULTIVATION. — This crop is important in the Cambodian provinces of Battambang, Kompong-Khom, and Preyveng. and, according to M. BRENIER, it constitutes the greatest part of the export from this region (50 000 to 60 000 metric tons.) Only recently introduced into Cochin-China, it occupies a preponderant place in the province of Chaudôc and is cultivated in certain cantons in the province of Longxuyen.

The first experiments on the cultivation of floating rice were made in Cochin-China in 1900 by PHAN-VAN-VANG, with seeds brought from the north of Kratie (Cambodia). The growers quickly saw the advantage to be gained, in a region subjected during 6 months of the year to heavy floods, by the cultivation of a rice capable of following the rising of the waters. Since then the cultivation of floating rice has increased steadily until at the present moment it covers from 70 to 80 % of the total cultivated area of the province of Chaudôc, i. e., 63 000 to 72 000 hectares ; the production amounts to from 115 000 to 130 000 metric tons.

GROWTH OF FLOATING RICE. — During the first two months of its growth, floating rice develops aerial roots like ordinary rice and puts out as many as 15 shoots per plant. When this stage is past, in order that it may prosper normally its stem must be completely submerged. This condition is realised in the low-lying plains, where it is grown thanks to the annual rising of the Mékong. As the waters rise the floating rice rises with them, keeping the tips of its leaves on the surface all the time. Its

(1) *Bulletin du Laboratoire d'Agronomie Coloniale*, edited by M. A. CHEVALIER, No. 1. Espèces et variétés de riz de l'Indo-China, par M.lle CAMUS, p. 18. (*Author's Note*)

roots then grow vertically and continue to lengthen out, forming fresh nodes. At the same time from each node spring rootlets which, in the marshy water, ensure the nourishment of the plant concurrently with the roots in the ground.

At Chaudôc the plain is constantly covered from July, to November with water varying in depth increasing towards the 15th and 30th of each lunar month and generally reaching its maximum in September or October. The depth of water varies on the average from 1.20 m. to 1.50 m. A heavy gradual flood is best for the growth of floating rice. It has been found that the water should not rise more than 10 or 12 cm. if the rice is to rise with it.

The water should subside gradually, for a sudden fall prevents the plant attaining its full development and deprives the grains of nourishment just as a rapid rise is unfavourable by submerging it, thereby weakening and sometimes destroying it. For instance, in 1917, a very favourable year for floating rice, at Chaudôc the rising waters were at first 2.15 m. deep (July 1) and finally attained a maximum of 4.82 m. in the first days of November.

When the water subsides, the floating rice gradually sinks until it lies flat, and from the nodes near the tip, branches shoot (one per node) which may, in turn, form one or two ramifications. There may be 3 to 5 branches per stem, each bearing a panicle. The tertiary ramifications, not having time to develop completely, do not bear grain. In a field of floating rice the branches, which all right themselves, slope in one direction so that the field presents a very different appearance from that of a field of ordinary rice which stands straight up, except in case of lodging. The lower part of the stalk which lies flat on the ground, rots and the healthy part obtains nourishment by striking roots from each node into the ground. From these nodes in contact with the soil there may spring secondary stalks which also take root and live a separate existence from the mother plant thus leading to propagation by shoots.

The stalk of the floating rice is thicker and harder than that of ordinary rice, but it is more brittle when dry. When it has finished growing, it may measure, so the growers say, from 2.50 to 5 metres in length.

The author, examining the stalks of the Nam-vian variety, has observed that the length varies from 3.50 to 3.70 metres. The internodes are very numerous : from 9 to 15 on each stalk. The internodes of the lower part of the parent stalk are the most developed (as much as 50 cm.), and become shorter as they reach the top (15 to 20 cm.) On the branches the author has noticed the contrary ; as they become more remote from the parent stalk the internodes are longer (6, 11, 12, 18, and 25 cm.). In ordinary rice the number of internodes is rarely more than 3 to 5. No noticeable difference exists between the leaf of the floating and ordinary rice, except that the parent stalk is bare for a considerable height and only has leaves on the upper part where the branches are given off. Floating rice, therefore, is very different from ordinary rice both morphologically

and physiologically and, according to the author, ought to be placed in the genus *oryza* as a distinct botanical variety.

VARIETIES. — In 1901 only one variety of floating rice was known in Cochin-China, but in 1906 M. PAUCHOUT (1) described 10 varieties several of which are no longer grown. The cultivated varieties all come from Cambodia and there are now 6 in the Chaudôc region. There is little difference between them from the point of view of vegetation, but they ripen at different dates covering a period of 30 days.

The period of growth of all these varieties varies between 8 and 9 months ; sown in April or May they are harvested in December or January.

The seeds of all these varieties fall very easily, and they often contain a variable proportion of red seeds. There are also varieties of floating rice with entirely red grains. These red grains are sometimes in demand among Chinese buyers, probably for distilling purposes. There is also a glutinous variety of floating rice, but the grains, however, are less glutinous than those of the ordinary glutinous rice and have no smell.

CULTIVATION. — Towards the end of the first Annamite month, after the crops have been gathered in, the straw, which was left on the ground at the time of the harvest, is burnt. During the second month when the first rains fall the ploughing is done. According to the altitude the soil is exposed to the sun during a period ranging from 1 to 2 months, so that, in the low-lying districts sowing time falls in the third month and in the forurth month where the elevation is higher. Sowing is generally done by hand and harrowing is necessary to even the seeds.

Rice and maize are sometimes cultivated together, and are sowu in alternate rows (2 of rice to 1 of maize) at a distance of 40 cm. or in pockets spaced at 20 cm. in every direction. The maize is sown 15 days before the rice. In any case the quantity of rice sown varies from 3 to 5 *gia* (2) per hectare ; for ordinary rice that is to be transplanted 1 *gia* per hectare is sufficient. Floating rice requires no care ; its growth is assisted by the floods and it flowers about November when the waters subside, and matures in December to January.

At this period the rice is cut with a sickle at a height of about 50 cm. as with ordinary rice ; the rest of the straw, which is left in the ground, is burnt later on. The ground is dr y at harvest time.

YIELD. — This varies from 80 to 150 *gia* per hectare according to the nature of the ground and the height of the floods. The average yield is from 80 to 100 *gia*.

COMMERCIAL GRADES OF FLOATING RICE. — Because of the way in which it is grown, floating rice is always more or less mud-stained and dirty But, yielding large and usually plump grains, it has the advantage of being heavy, giving 24 kg. per gia of 40 litres. Its weak point is that it often contains a rather large proportion of red grains which require a

(1) PAUCHOUT. Note on the cultivation of floating rice in the province of Chaudôc. *Revue Indochinoise* 1906. (*Ed.*)

(2) The Annamite *gia* = 40 litres. (*Ed.*)

longer polishing process, and yield more subsidiary products. Fortunately, this percentage of red grains has considerably decreased during the last years, thanks to the careful selection of seeds by the growers. At the Rice Competition organised in 1902 by the Saïgon Chamber of Commerce, floating immediately after its introduction into Cochin-China, was described as follows : — Round, well-developed grain, well adapted for polishing and blanching and on the whole possessing excellent commercial properties. More recently, at the exhibition of Rice Paddy and Maize organised by the Institut colonial de Marseille in 1911, a sample, submitted for examination to the Rizières Méridionales of that town was judged equal to the large grained Moulmein rice. For the native palate floating rice has not the same flavour as ordinary rice. It is considered that roasting makes it hard and insufficiently adhesive. Apart from this slight disadvantage, no complaint is made against it. At Chaudôc, the local trades do not differentiate between ordinary and floating rice if the latter is entirely white. For lots containing red grains the buyer varies his price according to the smaller or larger percentage of these grains and the cheapest quality generally, sold at 5 *piastres* per 100 *gia*, may, in certain cases, fetch up to 12 *piastres*. The market-price of the *picul* of paddy at Chaudôc is usually 0.50 less that at Cholon. Floating rice, owing to the size of its grains, which is over the average, is useful for export. With this object in view it is worth while for the growers to eliminate the red grains from their seeds. At the harvest they could put aside the panicles and sort them one by one. As the red grains are usually to be found on entire panicles it would be sufficient to decorticate one seed per panicle, setting aside the panicles which contain red grains. This simple operation could be entrusted to children, who, as it is well known, are to be found in respectable numbers in Annamite families.

Until the low-lying plains of the North-West of Cochin-China are raised, only floating rice can be grown in these districts. Requiring a minimum of care, it is sufficiently renumerative, thanks to its fairly, good and regular yield. It is to be hoped that this crop will extend over the low-lying lands where the rising of the Mékong leads to real floods. The utilisation of the vast plain of rushes will have every prospect of success if floating rice is grown.

744 – **Preliminary Experiments with Fertilisers in Rice growing in Indo-China.** — VERNET, G. and NGUYÊU-DUC LONG, in the *Bulletin Agricole de l'Institut Scientifique de Saïgon*. Year II, No. 2, pp. 52-53. Saigon, February, 1920.

The authors have made preliminary experiments on the use of fertilisers in rice growing. Unfortunately, the experiments are very incomplete because the rice fields belonged to natives who were not greatly interested in the question, and because they were made at a time when the rice was already transplanted therefore the observations could not apply to the entire harvest. The first conclusion to be drawn from these experiments is that, from an experimental point of view, it is useless to make them upon the native crops and more searching ones must, therefore, be made under different conditions.

Norwegian and Laos *nitrates* applied at the rate of 250 and 500 kg. per hectare gave good results, but it is impossible to make any comparison with the control plots for the reasons already given.

Lime applied at the rate of 1000 kg. per hectare had no visible effect upon rice already transplanted in the ricefields of Hocmon. The premature harvesting of the crops by the natives presented any comparison being made as regards the yield. *Calcium cyanamide* applied in the quantities indicated by the Congress of Rice Cultivation at Valencia as representing the nitrogen necessary for the whole crops, proved to be poisonous to the rice already planted in Indo-China.

When given at the rate of 500 kg. per hectare, in the low-lying parts of the field where the water accumulated most, the rice was literally burnt. But the poisonous effect was only temporary, for some of the rice plants, which were not completely killed, were able to resist and prosper.

But if calcium cyanamide, applied in such large quatities to rice already under cultivation proves poisonous it nevertheless appears to have a very different effect when applied in very small amounts. Cyanamide is a very fine powder and it is very difficult when speading to prevent the wind carrying some of the fertiliser on to the neighbouring plots. This is precisely what happened, and the authors show that where the wind carried a little of the cyanamide powder the growth of the rice showed excellent results. When the crops were gathered 10 panicles where no cyanamide was used only gave 754 grains weighing 16.87 gm. or an average weight per grain of paddy of 0.0223 gm. whereas 10 panicles with cyanamide gave 1428 grains weighing 32.158 gm., or an average weight per grain of paddy of 0.0225 gm. These results are interesting but the experiments need to be repeated and made more definite; for this reason M. MAGEN, Director of the Agricultural Department of the Scientific Institute of Indo-China, immediately arranged to send for a speader which could be regulated so as to permit the scattering the fertiliser evenly in small quantities on the growing rice.

745 - **Some Selected Rice Varieties in India.** — See No. 737 of this *Review*.

746 - **On the High Nitrogenous Content of Certain Cambodian Manioes.**— AMMANN, P., in *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 22, pp. 1333-1334. Paris, May 31, 1920. SUGAR CROP

Manioc, whose roots constitute a source of much sought after food products (flour, starch, tapioca, etc.), is one of the principal food crops in the equatorial zone.

Many varieties are known, but in every case the extremely low nitrogen content of the roots is very noticeable; it has thus been usual to consider manioc simply as a source of starch.

PAYEN gives 3.51% as the content of nitrogenous matter; Theodore PEKELT gives 2.5 and 3%, respectively, for white and red manioc (these figures are calculated on the dry matter).

Source	Moisture	Matter Nitrogenous
Madagascar	16.05	0.74
»	13.87	0.82
»	13.55	1.17
Nossi-Bé	12.16	0.91
Réunion	12.61	0.64
Guinea	13.68	1.40
Dahomey	13.81	0.82
»	12.46	1.49
»	12.21	1.23
Annam	14.23	0.96

Several analyses of manioc made in the Laboratory of the Jardin Colonial from various sources have revealed still lower contents of nitrogenous matter.

In addition to this, the Economic Agency of Indo China sent, for analysis to the Jardin Colonial, roots of Cambodian manioc, which had a much higher nitrogenous content. The roots came from plants grown from seed at Pnom-Penh by Mr. DE FLACOURT, Director of the Agricultural Department of Cambodia, with a view of obtaining new varieties. The plants from these seeds were carefully studied and selected, and amongst the new varieties obtained, 5 showed outstanding qualities with regard to early maturity or good yield.

The chemical composition was found to be as follows :

	Register No al the Jardin Colonial					
	15.858 153 A 1 %	15.859 154 A 2 %	15.860 155 A 3 %	15.861 156 A 4 %	15.862 157 A 5 %	15.863 158 A 6 %
Moisture	11.58	11.02	11.16	11.06	11.00	10.72
Nitrogenous matter	2.93	4.33	4.33	4.33	6.93	7.43
Saccharifiable matter	74.00	75.30	76.00	77.60	70.00	75.60
Crude cellulose	2.70	2.65	2.73	2.10	2.55	2.13
Ash	2.48	2.80	2.50	2.74	2.88	2.74
Hydrocyanic acid (in mgm per 100 gm of matter)	3.7	4.7	2.2	7.8	6.0	2.4

These new varieties of manioc come under the heading of the sweet manioes, i. e., containing only slight traces of hydrocyanic acid (confirmed by analyses). However, in order to estimate only nitrogenous nutrients, the analyses were made after complete elimination of the hydrocyanic acid.

FORAGE CROPS MEADOWS AND PASTURES

747 – **Cultivation of Ghessab (*Pennisetum spicatum*) at Rome.** — PANTANELLI E., in *Stazioni sperimentali agrarie italiane*, Vol. LIII, Pts. 1-3, pp. 47-66, bibliogr. of 37 works. Modena, 1920.

Owing to the necessity of finding summer fodder crops adapted to arid countries and to soils that lack water, the author conducted experiments near Rome with several Gramineae of subtropical origin. The

good results obtained with *Sorghum halepense* have been described in a previous article (1); this time an account is given of the results obtained with ghessab (*Pennisetum spicatum*) which with its varieties *typhoideum* and *vulpinum* is grown in Abyssinia and Erithrea, under the name of "bultuc", chiefly as a cereal; in Central Africa as a cereal; in Tripoli, Cyrenaica, Fezzan, etc., it is called "gsab", "gassab" and "abora" and in Algeria "bescua" (cereal and fodder crop): in the Belgian Congo it is grown as a cereal and fodder crop; in India as a cereal and fodder crop, known as "bajre" or "cumbu." The fodder value of *P. spicatum* is recognised throughout East and North Africa. In Italy, *P. spicatum* has already been given a trial on the Bolgheri estate (Pisan Maremma) and in Florence; although in these two cases the sowings were made very late (May and June), there was an excellent yield of fodder in the autumn.

In the trials conducted by the author, the seed used was provided by the Agricultural Department of Tripoli; and sowings were made on April 16, 1919, on friable, poor land, without fertilisers, in rows 25 cm. apart. In spite of the very warm dry summer, *Pennisetum* remained swollen and green; flowering began in July and lasted until the advent of the September rains; only ¼ of the plants produced completely matured seeds. In September, the plants had reached a minimum height of 90 cm. and a maximum of 120 cm. The harvest on September 15, yielded 347.7 cwt. per acre of hay with an approximate moisture content of 75 %, so that the yield of hay with 15 % of moisture corresponded to 153.86 cwt. per acre. The yield would doubtless have been even higher if second cut had been taken in July.

In the United States, the yields have been much higher; for example Mr. GARRISON in South Carolina, obtained 840.15 cwt. per acre for 6 cwt, the first taking place 54 days after sowing, and in Kentucky 696.19 cwt. of green fodder, i. e., 291.8 cwt. of hay for 2 cuts.

The plant cut down whilst in flower, dried at 90°C. and powdered (containing only 12 % of moisture) had the following composition:

Crude protein (N × 6.25)	12 % (52.3 % digestible)
Crude fat (Ether extract)	3.91 %
Carbohydrates (sugar)	25.10 %
Cellulose	36.14 %
Ash	10.16 %

Cattle having shown a distinct liking for this plant, the author concludes that, if cultivated in Latium, it would prove a summer fodder crop of the first quality.

If the grain is allowed to ripen on the early flowering panicles, it is possible to obtain, even in Latium, a sufficient quantity of seed to ensure continuity to the crop without having recourse to African seed. In the arid regions of the Roman Campagna, 26.74 lb., per acre is sufficient, leaving 9.84 ins. between the rows, to give a crop which can even be cut with a machine, and at the close of the summer, used as pasture, which

(1) See *R.* February, 1920, No. 202. (*Ed.*)

is tolerated well by *Pennisetum*. The plant grows with such vigour that all other plants are choked. It is extraordinarily bushy with an average of 12 stems per plant, and, when the seeds ripen, the green plant continues to send out shoots from the axils of all the leaves. It is advisable to remove the ears as soon as it is certain that the grain will ripen. In this way the other ears on the same stalk ripen more rapidly. The author briefly surveys the trials made in various countries with other varieties of *Pennisetum* proving that this genus provides a fodder crop of inestimable value for semi-arid regions, and he considers that " this species should be systematically tested in southern Italy and the adjoining islands.

748 - ***Lotus Corniculatus* in Seine et Oise, France.** — De Rotschild, H, in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 20, pp 505-508. Paris, May 26, 1920.

As it was necessary to cultivate large areas of impermeable land in the Rambouillet district, Seine-et-Oise, the author kept the fact in mind that with a view to rational and economic improvement, it is important to give the first place to plants which are the best adapted to the soil fertility as it stands.

In January, 1919, having analysed the hay from the various natural meadow lands, and after carefully examining the natural flora, the author found that the lotus plant, particularly *Lotus corniculatus* was growing wild on the plateaux and slopes and in the valleys, and gave promise of success on the shallow, alluvial undrained upland territory, where alfalfa and sainfoin are only occasionally found.

In 1919, seeds were sown at the rate of 2.6 lb. per acre with evident success, the plants varying in height, according to the type of soil, from 3.9 to 15.7 in., and in exceptional cases to 23.6 in.

From the standpoint of food value, the lotus is at least equivalent in value to alfalfa and sainfoin. New shoots are sent out continuously when it is grazed with cattle and even during an exceptionally dry season. It is therefore a valuable leguminous plant for poor regions which have limited forage resources, with a view to its use as an improving crop.

M. Schribaux agrees with M. De Rotschild in recommending that the lotus should be grown either alone or mixed with *Dactylis glomerata* as a protection crop. *L. corniculatus* is without doubt a forage crop of the first order, and has been up till now too much overlooked, although it deserves to be classed in the same category as alfalfa or clover. This hardy plant can apparently adapt itself to practically all types of soil, and flourishes in all parts of France regardless of climate. It is resistant to disease, productive, of good fodder value, lends itself as readily to pasture as to hay production and continues growing indefinitely. A heavy top dressing of phosphatic and potassic fertilisers is necessary to ensure satisfactory results. The high price of the seeds, which are difficult to obtain, is the sole disadvantage attached to the plant.

749 – **The Australian Saltbush (*Atripplex semibaccata*) in the United States.** Mc KEE, R., in *U. S. Department of Agriculture, Bulletin* No. 617, pp. 1-11, figs. 4. Washington, D. C., September, 1919.

The Australian saltbush (*Atriplex semibaccata*) was introduced into the United States some 25 years ago, and was distributed throughout the arid and semi-arid regions. In practically all cases, the plantations resulted in failure, and only along the coast, in the San Joaquin and Imperial Valleys of California, and in the Salt River, Yuma, and Santa Cruz Valleys of Arizona has it become well established. The plant is a perennial and prostrate, forming a dense mass from 6 to 12 inches thick. The minimum temperature of the regions in which it is naturalised is 19° F; the mean annual rainfall in regions where it is possible to cultivate without irrigation ranges from 9-16 in. While the Australian saltbush can grow on practically all types of soil, it is found in but few regions where the soil does not contain an appreciable amount of alkali. It is quite drought resistant, but apparently not to the extent of some other species of *Atriplex* and other desert plants.

The chemical composition of the leaves and stems of *A. semibaccata*, and of the hay therefrom shows respectively: Water, 78.03 and 7.05 %; ash, 4.58 and 19.37 %; crude protein, 2.75 and 11.64 %; crude fibre, 3.75 and 15.83 %; nitrogen-free extract, 10.41 and 44.05 %; crude fat, 48 and 2.01 %. The stems and leaves have therefore an unusually high content of salt (especially sodium chloride) and comparatively high percentages of protein, nitrogen-free extract, and crude fat.

In regions which offer favourable conditions, *semibaccata* is quite aggressive, and this adds to its value as a range plant. On account of its high salt content it is not as palatable as most ordinary forage crops, but it is eaten readily by sheep, goats, cattle and horses when other feeds are scarce. To be of the greatest value it must be supplemented with other feeds.

The greatest value of this plant is to supply succulent feed in late summer and to furnish a reserve supply. It can be used as a soiling crop, but has little value as hay. Seed is produced freely, but harvesting is expensive. For range purposes *A. semibaccata* should be sown in the autumn, scattering the seeds broadcast in favourable locations and leaving it to take care of itself. In sowing with a view to cultivation, the best time is in the spring and care should be taken to cover the seed only enough to ensure moisture conditions favourable to germination.

750 – **Silage Crops other than Maize in Canada.** — TRUEMAN, J. M., SUMMERBY, R. BARTON, H., BROTHER ATHANASE, TOOLE, W., ELLIS, J. H., BRACKEN, J., McCAIG, J. and BOVING, P. A., in *The Agricultural Gazette of Canada*, Vol. VI, No. 6, pp. 538-544. tawa, June, 1919.

Information concerning silage crops other than maize from various parts of Canada, including alfalfa, rye, clover, soya, Sudan grass (*Sorgum exiguum*), millet, rape, buckwheat, sunflower, mixed cereals, peas, and vetches.

Experiments conducted during 5 successive years at the Nova Scotia Agricultural College show that a mixture of oats, peas, and vetches will produce, under the prevailing climatic conditions, a larger yield of ensilage than maize, which rarely ripens satisfactorily. The average analyses of this mixture and of immature maize are compared as follows : Water, 74.76 to 81.54 % ; ash, 1.72 to 1.24 % ; protein, 2.60 to 2.02 % ; carbohydrates, 19.96 to 14,25 % ; fat, 0.91 to 0.66 %. This mixture, therefore possesses a higher nutritive value. The seed is sown at the rate of 3 ½ bus. per acre, the mixture being composed of 2 ½ bus. oats; ¾ bus. peas, and ⅓ bus. of common vetch. This should be sown as early as possible on rich land ; the green crop is cut before the oats turn yellow and is put in the silo through a silage cutter, and care must be taken to tramp it well down.

Wherever maize has not been a complete success, a mixture of peas and oats appears to give the best results.

Peas, soya beans, common vetch, hairy vetch, clover, alfalfa, and wood vetch put separately in the silo were not liked by the cattle as much as when mixed with maize ; what is more, fodder prepared thus kept in good condition much longer.

Artichoke stems moistened with a little water and slightly packed when put into the silo, gave a feed, mixed with maize, of excellent quality. The same was noticied with a mixture of maize and sunflower heads.

At the Manitoba Agricultural Colleges 7 silos were filled in 1918 with different fodder crops, and the appended table shows the results obtained. It is suggested that when the maize crop does not succeed, the best substitute appears to be a mixture of cereals (wheat, barley and oats), with equal quantities of peas, or, preferably, with Sudan grass (*Sorghum exiguum.*) Alfalfa may be ensiled it owing to wet weather, it is difficult to cure for hay, but ensilage from this crop is rather dry. Buckwheat and rape both make a very succulent ensilage, but are difficult to harvest.

	Maize		Sudan grass		Millet		Alfalfa		Cereals and Peas		Rape		Buck-wheat	
	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.
Green weight per acre	18	1560	5	1320	15	506	5 Sec. Cutting		12	380	30	280	13	1,720
Air dried weight of silage . . . . . %	15.90		20.15		20.53		46.69		20.83		14.06		18.25	
Analyses:							55.45							
Water . . . . . %	85.34		70.53		80.08		4.71		80.49		86.57		82.46	
Ash . . . . . %	1.34		2.24		2.28		8.30		1.63		2.09		2.40	
Crude Protein . %	2.46		3.83		3.13		9.44		4.02		2.87		3.71	
Crude fibre . . %	3.31		9.00		4.44		19.90		5.16		1.95		3.93	
Nitrogen free extract %	6.97		12.91		9.09		2.19		7.58		5.40		6.66	
Ether extract . . %	0.56		1.49		0.86				1.02		1.12		0.84	

Sunflowers give very promising results as a silage crop ; the cattle ate the silage quite satisfactorily and produced rather more milk as a result It was however observed that it was more laxative than the oat silage. In Saskatoon (Saskatchewan,) the sunflower variety Giant Russian yielded twice as much green fodder as the corn.

In British Columbia relatively more red clover is made into silage than any other crop, except corn. Prof. BOVING recommends for this district a mixture of 1 bus. of oats + 1 bus of peas + ½ bus. of small horse beans + ½ bus. of vetches per acre.

751 - **Food and Fodder Plants.** — HOLLAND, J. H., in the *Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information*, Nos. 1 and 2, pp. 1-84. London, 1919.

Description of the most important food and fodder plants included in the Natural Orders : *Leguminosae, Gramineae, Cruciferae,* and *Rosaceae,* etc.

For each plant the author gives the chief countries of production, imports into the United Kingdom, the approximate production of some of the principal crops in the United Kingdom, brief details as to uses, and other notes of practical interest.

752 - **Cotton in Guiana** (1). — *Bulletin de l'Agence générale des Colonies* (formerly *Bulletin de l'Office Colonial*), Year XIII, No. 145, pp. 47-48. Paris-Melun, January, 1920. FIBRE CROPS

The cultivation of cotton was first stated in the Antilles, and the Caribs paid their annual tribute to the Spaniard in bales of cotton.

During the War of Secession the cultivation of cotton was developed in Guiana as well as in the other French Colonies, but unfortunately, was given up afterwards.

Today, however, more interest is taken in the crop. In Guadeloupe (2) and Martinique it is proposed to revive the abandoned industry. In the British Antilles the cultivation of cotton has been highly developed and there is an important production.

Guiana ought to follow this example, as it could compete successfully in the production of cotton (to which the future promises inde finite extension) with the other producing countries mentioned and even with the United States.

In Algeria drought is an obstacle to the cultivation of cotton ; this obstacle does not exist in the moist climate of Guiana, where cotton can be grown both in high and low-lying districts, in river and maritime alluvial soils as well as on mornes (3).

Between Oyapok and Vincent-Pinçon, all the low-lying ground is specially adapted for the production of excellent cotton. Cayenne cotton is particularly silky. The production of cotton requires relatively little labour and capital, and is suitable for small landowners ; it gives rapid results (cotton is obtained in 6 months) and yields 2 crops yearly, one in February,

(1) This article constitutes the 13th part of the Series entitled "La Culture du Cotonnier dans les Colonies françaises" *R.*, May, 1920, No. 522. (*Ed.*)

(2) See *R.*, May, 1920, No. 522, XI. (*Ed.*)

(3) Small isolated mountains. (*Ed.*)

the other in September. The cotton plant in Guiana has the peculiarity that it can be renewed indefinitely by cutting the stalk, when it becomes arborescent. Guiana cotton is one of the best in the world. Formerly, the market value had fallen so low that it was not worth while cultivating, and ceased to be produced in Guiana, but times have changed and the future is full of possibilities.

PLANTS YIELDING OILS, DYES, TANNINS ETC.

753 - **The "Betratra" a New Oil Plant of Madagascar.** — HEIM, F., GARRIGE, E. and HUSSON, M., in the *Bulletin de l'Agence générale des Colonies* (formerly *Bulletin de l'Office Colonial*, Year XII, No. 143, pp. 679-691. November, 1919; Year XIII, No. 145, pp. 14-21 Paris-Melun. January, 1920.

In the calcareous plateaux with a desert climate (or almost so) in the districts of Mahafaly and Bara (south-west of Madagascar) there grows a small tree called by the natives "Betratra," and whose oleaginous fruit is already, to some extent, utilised for local consumption. This plant is almost unknown botanically; we only possess some data concerning it furnished by JUMELLE and PERRIER DE LA BATHIE. JUMELLE sent the authors a case of fruit gathered in the Mahafaly district for the purpose of botanical, chemical and technical examination. The results of these studies are summarised in the present note. The plant, belonging to the Euphorbiaceae, is dioecious, it is a tree 16.4 to 19.6 ft. high, described at first by M. JUMELLE as belonging to the genus *Jatropha* under the name of *Jathropha mahafalensis* Jum., but the same author thinks that it would perhaps be better to exclude it from this genus and class it with the genus *Ricinodendron* under the name of *Ricinodendron mahafalense*.

The "Batratra" would appear to be a distinctly xerophilous plant adapted to the desert climate of its native country. The shell in which the fruit reaches the market is rather thin, but, on account of its adherence to the kernel, is difficult to remove.

Breaking up the fruit is of little practical value, as the oil cake must be regarded *a priori* as poisonous and useless as a cattle food, for which purpose the kernel alone, without the shell, must be used; 100 seeds yielded 81.4 % of kernels and 18.6 % of husks (to a total weight of 74.3 gm.). The yield of oil obtained by expression amounts to 40 % of the weight of the undecorticated nuts, which is very satisfactory. The yield obtained by extracting with ether in a SOXHLET apparatus is 44.64 % of the entire fruit and 57.68 % of the decorticated nuts.

Chemical examination of the oil (clear, without any characteristic odour, and of a pale golden yellow colour has shown that it is semi-drying; almost entirely formed of triglycerides of stearic and especially oleic acids with small amounts of these fatty acids in a free state, a small proportion of volatile fatty acids and a minute quantity of hydrolysed fatty acids in the form of triglycerides.

If "Betratra" oil is to be used in soap making it must, when saponified with potash, be worked with weak caustic solutions at the boil. It makes an excellent summer soap which requires the addition of winter oil to resist a temperature below + 5° C. The oil yields an excellent hard soda soap when mixed with copra and lard.

The oil would be of special value in the manufacture of soap paste for the texile industry and that indeed is its sole utility.

A study has been made of the oil cake from the point of view of its use as a fertiliser. It has an average content of fertilising elements, somewhat similiar to those found in flax, exotic rape, black mustard, *Guizotia Oleifera* and nuts. Its composition is as follows : Nitrogen, 5.43 % ; potash (K_2 O), 1.236 % ; phosphoric acid (P_2 O_5), 1.589 %.

RUBBER GUM AND RESIN PLANTS

754 – **Dangers which may occur through the Close Vicinity of the Coco-Palm in Hevea Plantations and Precautions to be taken when applying Organic Manure to these Plantations.** — De Wildeman, E., in the *Bulletin Agricole de l'Institut Scientifique de Saïgon*, Year II, No. 2, pp. 53-54. Saigon, February, 1920.

An experiment recently carried out in the Federated Malay States has shown that the vicinity of the coco palm to Hevea may be injurious especially to the latter.

In one plantation, the Heveas had been planted in rows between pre-existent coco palms which had been felled. The stipes of the palms had been split and buried in trenches between the rows of Heveas.

In 1907, it was observed that a large number of Heveas were a more or less seriously diseased. On examination, the roots were found to be attacked by one or both of the two fungi ; *Hymenochaete noxia* and *Poria hypolateritia*.

It was observed that the roots of all the diseased plants had struck down into the trenches where the stipes of the coco palm had been buried.

In a certain number of cases where the main root had not yet been affected by the mycelial filaments, it was possible to save the trees by removing the infected roots, which were, naturally, immediately burnt. But when the tap-root was attacked the Hevea had to be destroyed. Examination of the rotting stipes revealed the presence of the two fungi mentioned above and also of *Fomes lucidus*, a common fungus of tropical regions (1). This experiment proves, not only that the parasites of the coco palm can pass to the hevea, but also that great care is needed when applying organic matter. Such matter, (rotting trunks and stipes, branches of all kinds and leaves) may certainly constitute, and do constitute, a valuable source of humus towards which the roots will be attracted and from which they will derive part of their nourishment ; but if this matter is infected by noxious organisms, it may cause serious diseases, often fatal to the plantation. It is therefore important to exercise great care in making up manure in the form of mould. If there is any doubt about their value from the point of view of fungus mycelium, insect eggs or larvae, it will be necessary to disinfect or even burn them.

In the same way, great care must be taken in the use of green manures on the value of which too great stress cannot be laid. The truth must never be lost sight of that the more intensive the cultivation the greater the need of care and hygiene the manager of the plantation must keep

(1) See *R.* September 1918, No. 1 56. (*Ed.*)

watch over the health of his plants ; the State, by means of a department of plant pathology, must enable the planters to fight against the diseases which attack and will and more attack plantations in the tropics.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

755 – **Preparation of Cacao.** — TEISSONIER, P., in *Journal officiel de la Côte d'Ivoire*, Year XXV, No. 13. Bingerville, July 15, 1919.

The simplest process is to wash the cacao beans in order to remove the surrounding pulp, and then dry them in the sun. Beans thus treated are smooth to the touch, and of a light colour ; the inside is brownish, inclining somewhat to violet. Cacao prepared in this manner has a pronounced bitter taste and no special aroma, therefore the process is not only inadvisable, but should be forbidden, if the quality of the cacao is to be maintained.

A superior product is obtained by fermentation, and cacao so treated is of greater commercial value than that which is merely washed and dried. The beans are placed in boxes, tubs, or barrels, buried in soil with 15 or 20 cm. protruding. The bottoms of the receptacles are perforated with holes to allow of the liquid to escape. The size of the receptacles varies, but the larger the quantity they contain, the more regular and complete is the fermentation.

The cacao beans are packed in even layers, and the receptacles covered with sacks, mats, or simply banana-leaves ; this is done in the evening, and the beans are left until the morning of the third day, when they are removed to another receptacle, care being taken to place at the bottom those beans that were previously at the top, and to move those at the sides to the centre. This must be done every morning until the fermentation is complete ; in this manner, the fermentation is regular and the product perfect.

The length of the fermentation process varies according to the district and the air temperature, but it may last from 5 to 7 days. No precise directions can be given on the subject as the right time can only be learnt by practice. Some guidance may be afforded by the fact that fermentation at the Bingerville Agricultural Station takes 6 days.

The process is considered complete when the interior of the bean has assumed its characteristic red colour, and the beans are then placed in the sun until they are completely dried, for which purpose the cacao, is placed on mats, or better still, in rectangular boxes with sides not more than 10 cm. high. Very good drying-racks are made by nailing mats upon frames with raised edges and furnished with feet or placed on cross-bars of wood 20 cm. above the level of the ground. The cacao is spread out in thin layers ; it is frequently turned during the day, and taken indoors at night, so that it may not get damp. The drying process last from 4 to 6 days, according to the heat of the sun : it is complete when the beans crack on squeezing between the fingers.

After fermentation, there is always a larger or smaller amount of pulp still adhering to the beans ; in order to remove this, they are either rubbed on a table after being dried or shaken backwards and forwards in a bag. The cacao is then sifted, sorted and stored.

The skin of the fermented bean is dark-red and somewhat rough to the touch; the inside is light-chocolate colour, the centre being lighter than the periphery. The beans have a special flavour without the least trace of bitterness.

Even after drying, the cleaning of the cacao beans, which is effected in the above-mentioned manner, is not complete. In order entirely to remove the pulp adhering after fermentation, the beans should be washed immediately after taking them out of the receptacles, if this be possible. Washing does not improve the quality of the cacao, but it improves its appearance ; the colour of the skin is uniform, and smooth, like that of washed and unfermented beans ; drying takes place more rapidly, and all smell of fermentation is removed. The product thus treated, always fetches a higher price on the market.

Washing, however, should not be practised in order to conceal incomplete fermentation, which can easily be detected by the internal colour, and the taste of the beans, these being the same as in the case of fermented but unwashed cacao.

Now that cacao production in the Ivory Coast is making decided progress, it is necessary to induce the natives to adopt the best methods of preparation in order to maintain the quality that it has been reported to possess, by commercial and industrial experts, to obtain a uniform product for the whole colony by means of the adoption of the same method of preparation, and to ensure proper fermentation followed by washing the beans, whenever sufficient water is available.

756 – **Camomile Cultivation in Anjou, France.** — HITIER, H., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 18, pp. 467-469. Paris, May 12, 1920.

In the Department of Maine-et-Loire, medicinal plants, of which the camomile is the chief, are grown over more than 300 hectares. The number of camomile growers is about a thousand, not counting some 4000 persons engaged in cultivating and gathering the flowers.

The camomile produced in this district has special qualities of fragance and aroma which are due to the climate and soil of Anjou, but unfortunately the falling prices during the last few years appear to have discouraged the growers, who show an inclination to replace camomile by other, more paying, crops.

Camomile-growing is, however, very important because it is specially suited to small holdings, and provides remunerative occupation for all the members of the family.

757 – **The Insecticidal Properties of Different Parts of *Pyrethrum cinerariaefolium*, and of its Flower-Heads at Various Stages of Development** (1). — PASSARINI, N.,, in *Nuovo Giornale botanico italiano*, New Series, Vol. XXVII, Part 1, pp. 1-6. Sancasciano, Val di Pesa, January, 1920.

The author has compared the insecticidal properties of feverfew (*Pyrethrum cinerariaefolium*) from Dalmatia, Florence (Forestry Institute), Scandicci (Agricultural Institute) and Palermo (Botanic Garden),

(1) See *R.*, October-December 1919, No. 1151. (*Ed.*)

as well as those of ordinary insect powder, and found that they were all practically the same. The insects used in the experiments were the housefly, (*Musca domestica*), dog-flea (*Ctenecephalus canis*) and the ant (*Crematogaster scutellaris.*)

He also discovered that, although some investigators deny all insecticidal properties to the stem of pyrethrum, the leaves, roots, and stem when properly dried and ground, have all considerable insecticidal properties though to a less degree than the flower-heads.

No particular differences were found as regards the various parts of the flower head (ligulate florets of the ray, tubular florets of the disk, tracts of the involucre, and receptacles). Previous investigators were all agreed that the flower-heads should be gathered while still young, and before the rays have opened. In order to test this the author gathered flowers at different stages of growth from the bud to the fructification and after drying and powdering them, he tested their efficacity in destroying insects, and demonstrated the very evident superiority of fully-developed flowers-heads, and of those with rays entirely expanded. Thus the idea that the flowers ought to be gathered at an early stage can only be explained from the commercial standpoint, as the more mature the flowers, the more easily do the petals become detached and fall.

The author also tried the effect on mosquitoes of the fumes liberated during the incomplete combustion of pyrethrum, and found that the insects were stupified, but not killed, so that after some hours, they regained their wonted activity.

VARIOUS CROPS

758 – **The Use of "Falasco" in Paper Making.** — PAVARINO, G. L. and CASTELLARI, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. I,III, Pts. 1-3, pp. 32-46, tables 1. Modena, 1920.

In the neighbourhood of Pisa, the name "falasco" is applied to a bog plant, which is cut down and made into hay during the season when the marsh is dried up. The crop is generally gathered in July, before the fruiting stage. The falasco plants mainly belong to the natural orders Poaceae, Cyperaceae, Typhaceae, and Juncaceae as shown by the following list:

CHIEF SPECIES CONSTITUTING FALASCO HAY: Common reed (*Phragmites communis*); common sedge (*Carex riparia C. glauca, C. vulpina*); giant sedge (*C. maxima*); *C. pendula*; *C. stricta*; *C. paludosa*; *C. stellulata*; rush (*Scirpus lacustris*); *Sc. triqueter*; *Sc. Holoschoenus*; sea-rush (*Sc. maritimus*); *Cyperus textilis*; galingale (*C. longus*); *C. vegetus*; *C. Monti*; *Schoenus mariscus*; lesser reedmace (*Typha angustifolia*); great reedmace (*T. latifolia*); *Heleocharis palustris*; wood small reed (*Calamagrostis epigeios*); *Arundo Donax*; jointed rush (*Juncus articulatus*); thread rush (*J. filiformis*); common rush (*J. conglomeratus*); hard rush. (*J. effusus*); sea rush (*J. maritimus*); slender rush (*J. tenuis*); *J. obtusiflorus*; *J. tenageia*; branched bur-reed (*Sparganium ramosum*); *Glyceria aquatica*; arrowhead (*Sagittaria sagittaefolia*).

Plants intended for special use are collected separately when they have reached the required size. Usually the proprietors of the marsh sell the falasco as it stands ; the buyer pays a fixed sum per acre and himself takes the responsibility of the cutting, drying and transport. Only a part of the falacsco is used in the manufacture of ropes, matting, baskets, or to cover chairs, wine flasks, etc., or as stable litter, manure etc. A considerable number of plants rot away during the rainy season. The marshes in the Pisa district give an average annual yield of 20.2 cwt. of falasco per acre. On account of the present shortage of material for paper making, the author investigated the marsh plants in the Pisa district, in order to find out if they could be utilised in the paper industry in the same way as rushes were utilised during the war in the United States, and the marsh plants round the Masurien Lakes in Germany, where various species of *Sphagnum* and *Eriophorum* abound.

Special attention is drawn to the botanical, physiological, microscopical and chemical characters of the following species : *Carex paludosa*, *Phragmites communis*, *Scirpus lacustris*, *Typha angustifolia*, and *Cyperus longus*. The cellulose content was determined by chopping up and heating in a 6 % solution of caustic soda under a pressure of 3 atmospheres for over 3 hours, pouring off the liquid, filtering of the sediment, washing and bleaching with chloride of lime at the rate of 10 % of the vegetable material, pressing, and dryng. The data obtained are quoted in the appended table :

Name or Plant	Amount of material treated	Weight after treatment	Yield of Cellulose
Carex paludosa	200 g.	86 g.	43.0 %
Phragmites communis	200	95	47,5
Scirpus lacustris	200	91	45,5
Typha angustifolia	200	88	44,0
Cyperus longus	200	50	25,0

It will be seen that, with the exception of *Cyperus*, these marsh plants give a high yield of cellulose.

Bleaching the fibre with sulphur dioxide and permanganate of potash did not given as favourable results as with chloride of lime. It may be concluded that the principal falasco plants will furnish long, even fibres suitable for filtering. As the cellulose content does not notably differ from that of good paper-making plants, all the members of the falasco group may be considered as material especially adapted for paper-making. Experiments made in the laboratory on these same plants confirm these results.

759 – ***Muscari comosum*** **and** ***Hyacinthus ciliatus*** **as Forage and Economic Plants.** — See No. 795 of this *Review*.

FRUIT GROWING

760 - **An Account of the *Amygdaleae* and Apple Trees of the Cold Regions of Indo-China and South China** (1). — CHEVALIER, A., in *Comptes rendus de l'Académie des Scien-ces*, Vol. CLXX, No. 19, pp. 1127-1129. Paris, May 10, 1920.

Indo-China includes in the upper regions of Tonking, and Laos, and in the mountains of Annam, several million hectares of land capable of cultivation, where most of the plants of temperate and sub-temperate countries, viz., wheat, barley, hemp, flax, poppy, and nearly all the European fruit trees, can be grown.

The fruit-trees are already represented by species, or varieties, differing from those cultivated in France, and the author undertook his investigations with a view to improving the native trees or using them as stocks upon which to graft choice French varieties or for the purpose of obtaining hybrids by crossing them with these varieties. He was assisted in his researches by M. MIÉVILLE of the Agricultural Service of Indo-China. The plants were identified at the Museum Herbarium, and much help was afforded by M. J. CARDOTS, recent revision of the Asiatic Rosaceae.

The peach (*Persica vulgaris* Mill) is to be found almost every where in Tonking, but its numerous, ungrafted varieties are different from those cultivated in Europe. The species is said to be indigenous in China; it is very common in Yunnan, and the author has found it apparently wild among the brush wood on the Chapa massif in Tonking at altitudes varying from 1000 m. to 1500 m. A dwarf variety with pink double flowers (*P. nana* Mill.) is grown as an ornamental plant in gardens in China and Annam. Another variety with small spherical fruits with little pulp (*P. Davidiana* Carrière), which the author formerly met with in China, was frequently seen by him in the gardens of Tonking.

The author did not come across the almond tree, (*Amygdalus communis* L.) in Tonking and *Amygdalus cochin chinensis* Loureiro is a mystery to him. Very probably the tree was not an almond at all, for LOUREIRO frequently made similar mistakes with regard to other genera.

Plum-trees (*Prunus* spp.) are cultivated in may gardens in Tonking Laos, and in North Annam. They belong to the Himalayan and Chinese species, *Prunus triflora* Roxb. The author knows a farly large number of varieties which reproduce themselves from seed, some of which have violet, others pinkish white fruits, whilst some bear yellowish plums the size of a small *mirabelle*, or even smaller. These plums have a bitter favour, and need improving.

The Japanese plum (*Prunus Mume* Sieb. and Zucc.) is sometimes grown in gardens at Tonking mereby for the sake of its pretty double blossoms.

The apricot (*Armeniaca vulgaris* Lamk.) which was imported long ago from China, is also cultivated in Tonking gardens but it is a variety bearing small fruits with little pulp. It ripens in April in the Delta.

An indigenous cherry (*Cerasus Puddum* [Roxb] Wall) is found in the forests on the mountains in Tonking, at an altitude of about 800 m. near

(1) See *R.*, July-September, 1919, Nos. 908 and 909, and *R.*, February, 1920, No. 58. (*Ed*)

Langson, and at 1200 to 2400 m. at Traninh. It is a large tree with red flowers, the fruits are blackish red, very little pulp, and a bitter taste, being almost uneatable. The European cherries, however, graft very well on this stock.

The European apple-tree does not exist in China. Its place is taken by *Malus prunifolia* (*Willd.*) Borkh, an autonomous species, and not a hybrid (REHDER). It is farly commonly cultivated in Yunnan where it bears fruits resemble the Api apple, which ripen in May and June. These apple-trees have been introduced into some parts of Tonkin, and seem to have become acclimatised.

Two very interesting species of apple grow wild on the high plateaux of Indo-China. One is *Malus Doumeri* A. Chev. (*Pyrus Doumeri* Bois), which grows on Langbian and its spurs, at heights varying from 800 to 2000 m.; the other is *Malus laosensis* A. Chev. (= *Pyrus laosensis* Cardot), and is found at Traninh at an altitude of 1500 m., and therefore should grow also on certain mountains in Tonkin.

These two species form large trees producing fruit that resembles some of the Normandy cider apples, in shape, flavour, and colour. From these Tonking apples, M. MÉVILLE has made a beverage very like Normandy perry in colour. Although these two species grow in the depth of the forest and receive no care from the present mountain population, the author thinks it is very possible that at some distant date, they were cultivated and improved. Colour is given to this supposition by the presence of *M. Doumeri* and *M. laosensis* round some of the pagodas of Laos, where they are tended by the bonzes as sacred trees.

761 – **A Description of the Pear, Walnut, and Chestnut Trees of the Cold Districts of Indo-China and South China.** — CHEVALIER, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 170, No. 22, pp. 1335-1336. Paris, May 31, 1920.

The pear is represented in South China and Tonking by various cultivated species differing from *Pyrus communis*, and known under the collective name of Chinese pear-trees. Their fruit is full of stone-cells, contains but little juice, and is only fit for compotes, to this group belongs *Pyrus Semoni* Carrière, a variety of *P. ussuriensis* Max., which the author saw in a native garden at Thanh-Ba (Tonking); it is also to be found here and there in the central region. This pear is not grafted by the natives, but is propagated by slips or layering.

Two species of *Pyrus* occur wild in the mountainous regions of Indo-China, and can be used as stocks for cultivated pear-trees; one is *P. Pashia* Ham (includes *P. Kumaone* Done), remarkable for the polymorphism of its leaves, and the other is *P. granulosa* Bertol. The latter was found by the author in the experimental farm of the Pasteur Institute at Homba, in the Annam mountains, at an altitude of 1500 m., and its habit of growth is worthy of mention.

P. granulosa grows in the moist, virgin forests, it develops first in the humus in the forks of trees, like an epiphytic orchid, and sometimes at a height of 10 m. Gradually, the principal roots descend the supporting trunk, and finally reach the soil into which they penetrate. From this

time, the branches of the tree develop, bear flowers and fruit, the tree mingling its crown, which often has a diameter of 8 to 10 m., with that of its support.

In Yunnan, a very remarkable variety of the walnut is cultivated (*Juglans Duclouxiana* Dode). Its shells are very thin and fragile, but it is worth growing and has recently been planted at different places in Tonking and Laos. Another variety with very hard nut-shells (*J. sagittata* Dode) grows in the same region. Both these varieties yield an excellent wood that can replace common walnut in the manufacture of the butt-ends of rifles. In 1917, there was a stock of 10 000 tons of this wood at Yannanfou. During the war, the idea had been entertained of exploiting it for the purpose of supplying France, but eventually the wood of a genus of *Lager stroemia*, known under the native name of "Banlang," was chosen. Almost pure stands of this tree are to be seen in certain forests of Cochin-China and Cambodia.

Castanea Duclouxii Dode, a species regarded by the author as akin to *Castanea vulgaris* Lank. var. *yunammenis* Franchet, is an arborescent chestnut very common in Yunnan, bearing average sized fruits and reproducing itself from seed without there being any need of grafting. It should be known by its older name of *C. mollissima* Blume.

In November, 1909, M. Miéville sowed some chestnuts at Chapa (Tonking), and, by 1917 the seedlings had become trees bearing large fruit of good quality that ripened about October 10.

Quite recently, commandant Eon discovered in the mountainous region of the second military district of Tonking, a chestnut tree with very spiky fruits and hairy leaves of which the lower surface was quite silvery This seems to be a variety (*C. Eonii* Chev.) of the preceding species.

In Indo-China there are a dozen species of *Castanopsis*, some of which are closely related to the genus *Castanea*. One of them, *C. tribuloides* C. D. C., is cultivated in the middle region of Tonking (Pays de Détham), and from it, the natives obtain a nut much like hazel-nut in flavour.

762 - **The Mango in the Belgian Congo.** — Pynaert, L., in the *Bulletin agricole du Congo Belge*, Vol. X, Nos. 1-4, pp. 185-240, figs. 14. Brussels, March-December, 1919.

The mango (*Mangifera indica*) has been introduced into the Belgian Congo, but the fruits of the varieties found there are not to be compared with those usually eaten in India, the Antilles, and Central America. Those at present consumed in the Congo, with the exception of choicer kinds obtained in the Eastern Province and the Upper Kasai, are fibrous, have a very strong turpentine flavour, ripen unevenly and are only fit for cooking.

It is therefore necessary to introduce, and to propagate by means of grafting, good varieties with large fruits, containing few or no fibres, and with sweet and succulent pulp.

The mango is most suitable as a native crop in districts near the principal centres of the Colony. Anyone possessing a good variety could certainly sell the fruit for a high price.

The same attention should therefore be devoted to fruit tree cultivation in the Congo as in other Colonies. The mango is one of the most paying trees, and its fruit can be exported.

The author treats in detail the following questions: History, description, synonymy, distribution, and varieties of the mango (Florida, Ceylon, India, Java, Trinidad, Porto Rico and Cuba), the best varieties, methods of improvement, classification of the varieties, climate, propagation (seeds, inarching, layering, shield-grafting, cleft-grafting crown-grafting, the Goa system of grafting, etc.), soil cultivation, pruning, gathering, diseases, methods of using mangoes, packing and transport, exportation, market.

763 - **The Possibility of Cultivating *Feijoa Sellowiana* in Italy.** — PELLEGRINI, M., in *Rassegna della Produzione italiana, Numero specialmente dedicato all'Agricoltura, all'Alimentazione, ed alle Industrie derivanti*, Year IV, Sect. D., No. 6, p. 25, figs. 2 Milan, June, 1920.

This *Myrtacea* is a native of Estarn Brazil, and was introduced for the first time into Europe about 1890 by ANDRÉ, who tried to popularise it in South France, but without success. In 1901, it was introduced into California, where it spread rapidly . In Italy, *Feijoa Sellowiana* is sold by all large seedsmen, and it grows in the South of the Peninsula, the islands, and even in the North in very sheltered spots, such as the Ligurian Riviera.

It is a shrub 4 to 5 m. high ; it is not particular as to soil, resists drought and winds, and bears cold better than the lemon (the author found it could resist as much as —5° C). *F. Sellowiana* may be propagated by seeds or cuttings but the former soon lose their germinating power. The seed lings come up in 4 to 6 weeks after sowing, and the shrub flowers after 3 or 4 years at the latest. Experiments in grafting it on other *Myrtaceae* (*Eugenia* and *Psidium*) have, so far, proved unsuccessful.

The author considers that this species should be widely cultivated in Italy. The fruit is excellent, the shrub needs little care, and hitherto has not been attacked by special parasites.

764 - **The Vine in Madagascar.** — *Bulletin de l'Agence Générale des Colonies*, Ministère des Colonies, Year XIII, No. 146, p. 162. Paris-Melun, February, 1920. HORTICULTURE

The vine bears fruit in various regions in Madagascar. It is 1ound in Imérina, Ambositra, and Bétsiléo, where it produces very good fruit. The grapes, when ripe, have an excellent flavour, and many colonial vine-growers have succeeded in obtaining very fine table-grapes. The vine, however, has a low alcohol content, and is of somewhat inferior quality.

Experiments have been carried on for a certain number of years in order to determine the best local conditions for growing this vine, and to study the wine-making processes. A new step has been taken in this direction.

Owing to the extension of wine-growing in the Province of Fianarantsoa, and the importance of investigating and determining methods of wine-making in this region, the Governor-General of the Colony has

passed a decree establishing an oenological laboratory which will be directed by a medical inspector of the native Medical-Assistance Service.

765 - **Lime and American Vines.** — De Angelis D'Ossat, in *Le Stazioni sperimentali agrarie italiane*, Vol. LIII, Nos. 1-3, pp. 97-100, 1 plate. Modena, 1920.

In a preceding article (Il calcare e le viti americane, *Le stazioni sperimentali agrarie italiane*, vol. XLVII, pp. 603-620, 1914), the author expressed grave doubts as to the truth of the common opinion regarding the lime resistance of American vines. In the present paper, he gives the results of his subsequent observations, which confirm his previous statement. The experiments were carried out in the agricultural garden of the Istituto Superiore Agrario at Perugia, and on the farm of Casalina which is attached to it. The data obtained reveal very evident contradictions between the theories based on the acidometric scale, and the facts observed by Prof. De Angelis, of which a summary is given in the following table:

Vines	Theoretical resistance	Percentage tolerated at Perugia
	Per cent.	Per cent.
Labrusca	5	30,02 — 40,35
Labrusca × aestivalis	5	27,81 — 35,43
Riparia tomentosa	17,5	32,83
Riparia vigorosissima	15	22,34 — 40,76
Riparia glabra	12	36,99
Rupestris of Velletri	17,5	38,88
Riparia vigorosissima of Avellino	17,5	42,20

766 - **Vine Growing Experiments on Calcareous Soil.** — Sagnier, H., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 19, pp. 475-476. Paris, May 19, 1920.

The author communicated to the Académie a paper by MM. E. Zacahrewicz and A. Tacussel dealing with the results obtained with American vines and their hybrids in an experiment field, planted in 1891, on an estate at Fontaine de Vaucluse (Department of Vaucluse).

The experiments lasted for 28 years, and bore upon 68 varieties of different origin.

The soil is extremely calcareous. From the physical standpoint it consists at a depth of 30 cm., of 57 % of fine earth, and 43 % of lime. Its fertility is very low and it is extremely dry in summer.

Most of these varieties have disappeared, owing to their being unsuited to the soil, and probably also to lack of cultivation and manure, as the experiment field was left unmanured, on account of scarcity of labour during the 5 years of the war. The vines that did well, therefore, showed great powers of resistance.

From observations made in November 1919, the authors classified the survivors as follows:

Fairly robust varieties. Pineaux × Rupestris 1305; Couderc No. 1325; 174^{25} Couderc.

Robust varieties: Chasselas × Berlandieri 41 B; Berlandieri Ecole; 74^{40}; Couderc 132^{9}; Hybrid Berlandieri Malègue No. 6.

Very robust varieties; Berlandieri × Dr Dawin's Alicante; Bouschet; Dr. Dawin's Berlandieri with compound bunches; Berlandieri Resseguier Nos. 1 and 2; Aramon × Rupestris Ganzin Nos 1. and 9, Mourvèdre × Rupestris 1202; Rupestris du Lot.

MM. ZACHAREWICZ and TACUSSEL conclude by stating that, by means of these last varieties, it would by possible to reconstitute a vineyard successfully on most soils.

767 – **Different Varieties of White Malvoisie.** — SANNINO, F. A., in the *Rivista di Ampelografia*, Year I, No. 10, pp. 141-142. Alba-Leghorn, May 15, 1920.

Some wine-manufacturers have spread the belief that malvoisie is a vine producing aromatic grapes, that is fruit with a special odour and flavour very similar to those of muscatel. Under the name of malvoisie, however, a large number of black and white grapes (few red) are cultivated, and only some of these possess the characteristic odour which causes malvoisie to resemble muscatel.

The white malvoisies of Piedmonte, Asti and Alexandria, are really aromatic, and have been described and figured in Volume I of the " Vignoble " by MAS and PULLIAT (p. 145, pl. 73), and by ROVASENDA, in whose classification they appear under Nos. 53 and 57 as vines with oval grapes of fine flavour with smooth pips, and 3 or 5 glabrous lobed leaves.

The above mentioned plate in " Le Vignoble " represent a fine bunch with large, oval, light-yellow grapes having all the appearance of choice table-fruit. PULLAT, however, draws attention to the fact that, owing to its soft pulp, this grape must be regarded as a wine-making variety, Formerly, it was used either alone, or mixed with muscat grapes in the manufacture of a sparkling muscatel, which PULLAT considers too aromatic for French taste.

The idea is that all malvoisies are aromatic grapes and must have originated from the character of this Piedmontese variety.

Certainly the Tuscan, or Long malvoisie, is also aromatic. It has been described and figured in *L'Ampelografia Italiana* (Part. I, p. 17, pl. IV) and in MOLON's *Ampelografia* (Vol. II, p. 747, fig. 57); it is the same as the white Bari malvoisie the white Zante, the " Cannilunga " malvoisie of Novoli (Lecce), etc. and the Conegliano Prosecco.

The Lipari malvoisie decribed and figured in MOLONS' *Ampelografia* (Vol. II, p. 747 fig. 56) is an aromatic grape as Mendola also said. At Catania, in 1910, a considerable number of vines from the Lipari isles and bearing magnificent white grapes of a golden colour were pointed out to the author as belonging to the Lipari malvoisie variety. If however, the true Lipari malvoisie is aromatic, these Catanian vines, must be of another kind. In any case, the Lipari malvoisie wine is always without aroma and has the strong alcoholic flavour of *vin de paille.* If it is made from an

aromatic grape, the loss of aroma must be due to evaporation while the grapes are drying in the sun, which happens in the case of muscatels also.

Count ROVASENDA in his *Saggio di un' Ampelografia universale* after having classified all the vines from "malvagea" to the violet malvoisie of Istria, adds: "I have only arranged in order, and under the supervision of the vine-growers of different countries, the numerous varieties of malvoisie mentioned by other writers. It was not possible in this catalogue to indicate their identity or diversity. To do so would have entailed much discussion, and, further, given the present state of the knowledge of the subject, we feared that, assisted by our own experience alone, it would by impossible to evolve any order out of this chaos. In our opinion, the name malvoisie should only be given to aromatic grapes with the special flavour of a slightly bitter muscatel. There are, however, so many grapes of ordinary flavour bearing the name of malvoisie, that it is hopeless to try and deprive them of it, even though they have no right to the title."

In order to prevent all confusion in the future, the word aromatic should be added in the case of all malvoisies with an aroma like the Piedmontese variety. Those grapes that are not classified as aromatic, should be understood to be grapes of ordinary flavour. In ROVASENDA'S classification, all the numbers from 1 to 50 are such varieties, whereas numbers 51 to 110 include all varieties with the flavour of the muscatel, or of the Piedmontese aromatic malvoisie.

768 **"Duranthon", a Good Direct Bearer.** — STEVANO, A., in the *Rivista di Ampegilografia*. — Year I, Nos. 7-8, pp. 99-103. Alba-Leghorn, April 15, 1920.

During the last twenty years, the author has been testing, in his vineyard at Savigliano (Province of Cuneo) various hybrid direct bearers. The variety known as Capitaine Duranthon proved itself superior to all the others. It is in the first place distinguished by exceptional vegetative growth, its shoots attaining the length of from 6-7 m. after the third year, so that they can be trained, either in festoons, or on pergolas. The following characters of the hybrid were also observed: (1) Almost complete resistance to phylloxera; vines grown for 19 years on soil infected with phylloxera are still immune; (2) great resistance to fungoid disease; at the flowering season; it, however, requires one or two preventive sprayings; (3) abundant yield; from a single adult vine about 71 to 75 kg. of grapes, or half a hectolitre of wine, is obtained; the bunches, of which 3 are borne on a branch, are fairly closely-set, much winged, conical, and from 20 to 25 cm. long; the grapes are of medium size, and round; if hung in an uninfected room, they keep as long as one year without rotting; hence they can be used for liqueur wines (*vino santo*); (5) it produces much must; 1 hectolitre of must can be obtained from 140 to 146 kg. of fresh grapes or 120 kg. of grapes that have been kept for 20 days; (6) high sugar content; usually from 19 to 21 %; in 1919, it was as much as 31 %, which corresponds to 20 % of alcohol; (7) acidity, 8 per thousand; (8) wine with a pure smell and flavour; colour rather a dark-red, clear; it ages easily if left slightly in contact with the air; (9) it is not a table-grape, for the berries are

somewhat small, but the skim is thin, and the pulp detached ; (10) it ripens early (September 15-20,) but it begins vegetative growth equally early, which is a serious defect, as it is thus exposed to frosts. However, in 1919, after the frost of April 23 had destroyed $^9/_{10}$ of the normal ones, the new buds already contained young bunches, and yielded a crop almost as large as that of 1918 ; (11) " Duranthon " suffers from drought and therefore, is not suited to cultivation on hill slopes.

769 – **Good Vine-Stocks of the Trentino** (1). — ZANOTTI, L., in the *Rivista di Ampelografia* Year I, Nos. 7-8, pp. 113. Alba-Leghorn, April 15, 1920.

The vine, *Rupestris Göthe* No. 9, is characterised by well developed shoots that are proof against the rigours of the winter, and by large leaves which are, however, less glossy than those of *Rupestris metallica*. It is largely cultivated in Styria, where its good qualities make it preferred to other vines of the *Rupestris* variety. Its wood reaches complete maturity. This vine grafts well, and is easily propagated by slips. The graft grows luxuriantly, and the grapes ripen at the normal time. This *Rupestris* will grow in poor, dry, and stony soils, provided they do not contain above 25 % of soluble calcium carbonate. According to Zweifler, it appears to give excellent results, especially when the vines are grown low and pruned close.

Riparia × *Rupestris Schwarzmann* has recently become a favourite with vine-growers, who prefer it to *Riparia*. It much resembles the latter, but is superior on account of its harder, more compact wood, which is more resistant to the cold in winter, and to the alternations of frost and thawing. The long shoots of the hybrid assume a dark brown colour and ripen perfectly ; its large leaves recall those of *Riparia*, whereas it resembles *Rupestris* in the colour of the leaf-veins which are more or less red. The hybrid is generally very robust and grows luxuriantly. It cuttings strike easily, and it grafts well, the stock giving strength to the scion, which becomes almost as large as the stock, so that at the crown of these vines, there are none of the special constrictions peculiar to the *Riparia* variety. *Riparia* × *Rupestris* Sch. grows well in all soils suited to *Riparia*, and can adapt itself to those light, or heavy, soils where *Riparia* would suffer. It has, however,, the defect of being little tolerant of lime, only being able to resist 12 % of this substance. It hastens the ripening of the grapes and improves their quality.

770 – **Hybrid Vine-Stocks for Sicily** (2). — GRIMALDI, L., in *Italia vinicola ed agraria*, Year X, No. 11, p. 118. Casale Monferrato, March 14, 1920.

The following Italo-American hybrid vines have been specially recommended by Dr. PAULSEN for use in the reconstitution of vineyards in the centre of Sicily, taking into account the conditions prevalent in that part of the island.

FOR DRY CALCAREOUS, SANDY LOAM SOIL WITH HEAVY CALCAREOUS SUBSOIL. — *Paulsen hybrids* : Catarratto × Berlandieri 2 No. 779 and

(2) See *R.* June, 1919, N. 663. (*Ed.*)
(1) See *R.* June, 1920, No. 662. (*Ed.*)

Berlandieri × Aramon Rup. 1043; *Ruggeri Hybrids*: Berlandieri × Rup
du Lot 131 and 140.

FOR CALCAREOUS, CLAY LOAM SOILS WITH MARLY, FAIRLY DAMP SUBSOIL
— *Paulsen hybrids*: Berlandieri × Rupestris Martin 1381 and 1417; Ber
landieri 2 × Riparia Rupestris 2 A 1119; Berlandieri 2 × Riparia Rupestri
3309 No. 1776; *Ruggeri hybrids*: Albanello × Berlandieri 8 and 1
FOR DAMP, CALCAREOUS CLAY SOILS. — *Paulsen hybrids*: Cataratto ×
Berlandieri 2, No. 779; Berlandieri 2 × Mourvèdre Rupestris 120
No. 1322; *Ruggeri hybrids*: Berlandieri × Rupestris du Lot Nos. 13
and 142; *Grimaldi hybrids*: Troia × Rupestris 1132.

FOR SLIGHT CALCAREOUS, DAMP, SANDY LOAM SOILS. — *Paulsen hybrids*
Berlandieri 2 × Aramon Rupestris 1045; Berlandieri × Rupestris Mo
ticola 782; *Ruggeri hybrids*: Berlandieri × Rupestris du Lot; Be
landieri × Rupestris Metallica 122; Berlandieri × Riparia, 188, 20
225, 267.

A few years, however, are not long enough in order to judge of a ne
hybrid. It must be studied on its own roots, and also grafted, for mar
years. In hot districts vigorous development in the first few season
not always a good sign for the future. The affinity of the graft does n
reveal itself at once, sometimes only after 8 or 9 years have elapsed. T
preparation of the soil has much influence upon the growth of the hybri

FORESTRY

771 – **Investigations into the Effect of Forest upon Water Courses.** — ENGLER, (Director der Eidgen forstlichen Versuchsanstalt), in *Mitteilungen der Schweizerisch Zentralanstalt für das forstliche Versuchswesen*, Vol. XII, pp. XV + 526, figs. Zurich, 1919.

It has long been supposed that forests increase the water supp of streams (SURELL, DEMOUTZEY), but some doubt has recently been ca upon this theory, because it was not founded upon careful, reliable obse vation.

The late Prof. C. BOURGEOIS, Director of the Federal Forestry R search Station of Zurich, assisted by M. ZÜRCHER, the Forest Inspect had already undertaken some direct experiments with a view to determi ing the effect of forests upon the flow of streams. For this purpose selected in the Bernese Emmenthal, two valleys much resembling one a other, with the exception that one was entirely wooded, while only or third of the other was covered by forest. He measured the water flowi from each of these valleys.

The author continued this work, and has just published the resu of this 15 years (1903-1917) researches. On the one hand these confi certain statements that had been previously made while, on the oth they reveal some new facts.

The memoir contains numerous graphs and summaries of observatio

The two valleys in question are excavated in a conglomerate co posed of crystalline and calcareous rocks derived from different sourc and rendered impermeable by layers of marl, which is an indispensa e condition for such investigations. The climate is severe, the rainfl

eavy (about 1550 mm.), the average temperature of the air is only 6° C, nd westerly winds are the most prevalent.

The first of these valleys, the Sperbelgraben, situated at an altitude f from 912 to 1082 m., has an area of 56 hectares, of which 97 % is woods; contains 9 streams. The second valley, known as the Rappengraben, lies at an altitude of between 830 and 1060, its area is 70 hectares nd 35 % of it is wooded. Its waters are collected by 7 streams.

Pluviometers and recorders were set up in both valleys and the amount f water carried away by the streams was measured by means of a gauge, r calculated by the help of BAZIN'S formula.

It was found by careful investigation that the Sperbelgraben lost % of the water received while, on the other hand, the Rappengraben ad an additional amount, of 3 %, and this has been taken into account n all the calculations.

From 1903 to 1915, however, more rain fell by turns in one valley han in the other, with an average of 3 % in the favour of the thinly-vooded one. This result was in contradiction to what had been stated n other countries, namely that forests increase the rainfall. During the rowing season, that is to say, from May to October, 58 % of the total ain fell, in each valley and from November to April only 42 % of the vhole amount.

The forest soil is 5 % more porous than the agricultural soil to a lepth of 10 cm., and 1.1 % more at a depth varying from 40 to 50 cm., his increases its permeability.

As a result of experiments made in these two valleys, as well as at Swiss and foreign Forestry Stations, it has been found that the annual oss of water by evaporation amounts to :

123	mm.,	or	1230	cu.	m.	per	hectare	for wooded land
369	»	»	3690	»	»	»	»	land without woods
300	»	»	3000	»	»	»	»	trees
130	»	»	1300	»	»	»	»	field and meadow plants
65	»	»	650	»	»	»	»	pasture

The author compares the amount of the rainfall with that carried off by the streams, after the rapid melting of the snow, during storms nd long rainy seasons, during periods of drought at different seasons, nd on wooded and unwooded land.

After the rapid melting of the snow, the averages for Rappengraben, which is thinly wooded, are 11, 12, and 30 % higher than those for the other well-wooded valley.

After 6 storms, the average amount of water carried off from the Rappengraben was 3 % above that from the other valley. When the rain ad been continuous or in rainy seasons, the streams of first one valley, nd then the other carried off more water.

The graphic curves, although of different values, are parallel, which hows the regulating effect exercised by the forest upon the streams, even during periods of drought in summer and winter.

During the summer, that is to say, from April 16 to November 30, the Sperbelgraben valley gave up 69 % of the rainwater it received, and the Rappengraben did the same as against 31 % in winter. Since the water-flow is the same for both valleys, it must be admitted that the amount of water evaporating per season and per year is the same for land under forest and unwooded land.

Taking into account the observations made in the Emmenthal, it may be stated that, speaking generally, the rainwater is distributed as follows :

	In % of rainfall	
	Wooded land	Unwooded land
Water carried off by streams	60 %	60 %
Water adhering to plants, evaporated immediately . . .	15	10
Water absorbed by plant transpiration.	20	6
Water evaporated directly from the soil	5	24
Total	**100**	**100**

It therefore appears that, throughout the year in the Swiss pre-Alpine regions at altitudes up to 2000 m., the rainwater finds its way by surface drainage and infiltration directly into the streams, and that 40 % is evaporated by the soil and by plants.

The soil of wooded land, on account of its greated porosity, is more permeable than that of land bare of trees ; it absorbs a great quantity of water which percolates from it, whereas where there are no trees, this water collects and forms streams.

The matter derived from the erosion of rocks and from the detritus of water-satured land has a volume per hectare per annum of 0.85 cu. m. in the case of the Sperbelgraben (wooded), and 2.22 cu. m. in that of the Rappengraben (partly wooded).

To sum up, the forest regulates the flow of the streams without, however, increasing the amount of water. The first fact was already known, but it is of the utmost importance in the utilisation of great water power; therefore, foresters and engineers should consult together with a view to planting and maintaining forests for selection-felling. The second fact is quite new, and we should be very grateful to Prof. ENGLER for having proved it so decisively.

772 – **The Experimental Cultivation of Foreign Trees in Austria.** — ZEDERBAUER, E. (Mitteilung der deutschösterreichischer forstlichen Versuchsanstalt in Mariabrünn), in the *Centralblatt für das gesamte Forstwesen*, Year XLV. Parts 7-8, pp. 153-169. Vienna, 1919.

The first report on the experimental cultivation of foreign trees in Austria was drawn up in 1901. The present report deals with the plantations and experiments made by the Mariabrunn Forestry Experiment

Institute in the State forests, or in collaboration with other public or private establishments.

In 1901, the total number of experiment plots was 372 ; 266 for conifers and 106 for deciduous trees. In 1916, the total number had increased to 640 ; 513 for conifers and 127 for deciduous trees. The conifers chiefly cultivated, as being in most request, were: Douglas pine (*Pseudotsuga Douglasii*), Sitka spruce (*Picea sitchensis*), Weymouth pine (*Pinus Strobus*) and Japanese larch (*Larix leptolepis.*) The red oak (*Quercus rubra*) was the most commonly-grown deciduous tree.

From the results of the experiments so far carried out, the following trees seem worthy of recommendation :

(*a*) For the *Castanetum* : *Juglans nigra, Quercus rubra, Q. palustris, Fraxinus americana,* and *Pinus excelsa.*

(*b*) For the *Fagetum,* according to the locality : *Pseudotsuga Douglasii and P. glauca, Pinus Strobus, Picea Sitchensis, Chamaecyparis Lawsoniana, Thuja gigantea, Larix leptolepsis;* and for the lower *Fagetum* alone, *Juglans nigra, Quercus rubra, Carya alba* and *Fraxinus americana.*

(*c*) For the lower (*Picetum* : *Pseudotsuga glauca* and *P. Douglasii, Picea sitchensis.*

Picea pungens and *P. sitchensis* are fairly resistant to the attacks of large game ; they are both suitable for the *Picetum* and the *Fagetum.*

The number of foreign trees worth growing is limited, especially from the point view of timber, which must be better than, or different from, that of the native species, or else produced in larger quantities. The only trees presenting these advantages are : Douglas fir, Weymonth pine, Lawson cypress, giant Thuja, white hickory, and black walnut. The principal object lies in the utilisation of the timber ;otherwise, from an aesthetic point of view, many other trees could be recommended for gardens and parks.

In planting new experiment plots with foreign trees, a space of at least, 0.25 hectares should be allotted to each species, if a good return is to be obtained. With regard to trees of which the qualities have not yet been sufficiently tested, only a few hundred individuals ought to be planted per plot.

Further, as M. Cieslar has suggested, it would be advisable to plant from 2 to 3, or even more, hectares in different climatic zones, where trees suitable to the zone could first be raised, and then planted in 0.25 hectare experiment plots at the maximum most suited to each kind of tree. Indigenous trees should be grown for purposes of comparision with the foreign species.

773 - **Brazilian Timber.** — I. As madeiras do Brazil, in *Ministerio da Agricultura, Industria e Commercio, serviço de Informações* 2nd Edition, pp. 1-28. Rio de Janeiro, 1918. — II. Costa, A., Silvicultura, in *Questões Economicas,* pp. 79-102. *Ibid.* — III. Movimento economico do Brazil, in *Ministerio da Agricultura Industria e Commercio, Dados Estatisticos,* p. 50, pl. *Ibid.* — IV. Lopes I. S., Economic Notes on Brazil, Timber, in *Ministry of Agriculture, Industry and Commerce, Bureau of Information,* Third Edition, pp. 57-59, *Idem,* 1919. — V. Commercio e exportaçao de pinho in *Boletim do Ministerio da Agricul-*

tura, Industria e Commercio. Year VI, pp. 75-78, *Ibid.* — VI. Commercio exterior do Brazil, de Janeiro a Dezembro 1917-1918, in *Ministerio da Fazeinda, Directoria de Estatistica Commercial, Ibid.* — VII. WHITFORD, N. N. The Structure and use of the Parana Pine Forests of Brazil, in the *Journal of Forestry*, Vol. XVII, No. 2, pp. 154-158. Washington, 1918. VIII. MCLEAN, R. C., Studies in the Ecology of Tropical Forests, with Special Reference to the Forests of South Brazil, Introduction and Pt. I. Humidity, in *The Journal of Ecology*, Vol. VII, Nos. 1-2, pp. 5-54, figs 21, pl. 1. Cambridge *id.* — IX. DUMAS, L., La gelée au Brésil, in the *Annales de Gembloux*, Year XXVI, Pt. 3, pp. 118-122. Brussels, 1920. — X. Brasiliens Holzausfuhr, in *Der Tropenpflanzer*, Year XXIII, No. 1, pp. 22-23. Berlin, *id.* — XI. LONG J. D., Foreign Trade Situation in Para, Brazil, in *Commerce Reports*, No. 124, pp. 1158-1159. Washington, *id.* — XII. PESSÔA, E. (President of the Republic). Mensagem aprasentata ao Congresso Nacional na Apertura da Terceira Sessão da Decima Legislatura, in *Republica dos Estados Unidos do Brazil*, p. 146. Rio de Janeiro *id.*

X. XI. — Brazil possesses certain advantages which give promise of a brilliant future as a timber exporting country. The forests are often traversed by water courses that can be used for transport purposes to the port, of shipment. In the State of Amazonas, whose tropical climate also permits of speedy re-afforestation, specially favoured in this respect, and the evident possibilities of the exportation of timber from the States of Amazonas and Para will afford distinct compensation for the present stagnation in the rubber trade. Already in Para, the local timber has begun to be used in ship building. The timber exported does not only include that used for building but also for making sleepers, and for furniture etc.

II. III. VI. — Table I shows the exports of timber in the 6 years between 1913 and 1918.

TABLE I. — *Timber Export from Brazil, 1913 to 1918 (Metric tons).*

Tsencias	1913	1914	1915	1916	1917	1918
Mahogany	7	—	—	—	—	2,4
Mahogany (female)	0,6	—	452	371	649	3 103
Rosewood	2 464	2 799	1 840	1 388	648	314
Massaranduba	105	24	379	168	23	21
Araucaria (planks)	41,5	297	1 245	2 682	45 713*	152 021*
Brazilian Wood	—	—	39,5	238	384	8 36,5
Sebastio de Arruda	718	33	—	—	—	—
Timber (not specified)	2 299	2 322	1 481	1 481	10 280	13 504

* Round figures.

I. — Table II gives the chief forest species with their specific weight and resistance to pressure.

Of these, there are 30 suitable for building, 9 for ship building, hydraulics and submerged constructions in general, 15 for sleepers, 15 for furniture and veneering, 13 for beams and coach work, 10 for dyewoods and, in addition, 8 palms, 9 oil-bearing trees, 6 latex, 6 starch, 8 fibre,

TABLE II. — *Brazilian timbers.*

Brazilian timbers	Specific weight	Resistance to pressure
		kg.
Acapú (Mahogany)	1.067	930
Angelim amargoso (*Andira anthelmintica* Mart.)	0 984	684
Angelim pedra (*A. spectabilis* Sald. Gam.)	1.052	648
Angico (*Piptadenia rigida*) Benth.)	0.907	755
Araça pyranga	0.997	735
Araribá amarello (*Centrolobium robustum* Mart.)	0.870	729
» rosa (*Pinckneya rubescens* Fr. All.)	0.705	718
Arocira (*Schinus Aroeira* L.)	1.219	1 005
Barbatimão (*Stryphnodendron Barbatimão* Mart.)	1.275	1 015
Buranhen	0.869	612
Cambuhy preto	1.138	580
Canella Capitão Mór, *Nectandra myriantha* Meissn	0.735	407
Canella parda	0.764	1 079
» preta, *Nectandra mollis* Nees, *N. amara* Meissn	0.877	676
» sassafraz	1.082	772
Cangerana, *Cabralea Cangerana* Sald. Gam	0.824	546
Carnaubeira, *Corypha cerifera* L.	0.982	578
Carvalho vermelho	1.047	1 382
Cedro vermelho, cedrela	0.596	467
Copaiba, *Copaifera officinalis* L.	1.078	888
Faveiro	0.948	1 200
Gonçalo Alves, *Astronium fraxinifolium* Schott	1.033	850
Grossahy azeite	0.953	358
Guarajuba	0.963	727
Guarantan	0.968	1 640
Guaraúna	1.164	818
Guatumbú legitimo	0.797	1 209
Ingá-assú	0.647	565
Ipé tabaco, *Tecoma Ipé* Mart.	1.048	885
» una, *Tecoma curialis* Fr. All.	0.785	728
Itáuba preta, *Oreodaphne Hookeriana* Nees	1.067	923
Jacaranda cabiúna (palissandro)	0.872	791
» rosa (palissandro)	1.196	777
» tan (palissandro)	1.142	1 048
» violeta (palissandro)	1.155	1 073
Jatahy, *Hymenaea Courbaril* L.	0.902	1 315
Jequitibá vermelho	0.665	938
Louro, *Cordia Hypoleuca* DC.	0.923	681
Massaranduba grande	1.079	760
Oity	0.792	536
Oleo pardo, *Myrocarpus frondosus* Fr. All.	0.667	716
» vermelho, *Megrospermum erythroxylum* Fr. All.	0.954	762
Páo Brasil, *Cæsalpina echinata* L.	1.185	1 361
» Ferro, *Swartzia tomentosa* DC.	1.270	951
Pequiá amarello	0.871	755
» marfim, *Aspidosperma eburneum* Mart	0.836	741
Peroba amarella, *A. Peroba* Fr. All.	0.794	668
» parda, *A. Gomezianum* Fr. All.	0.854	607
» revessa, *A.* sp.	0.852	663
rosa	0.929	804

Brazilian timbers	Specific weight	Resistance to pressure
		kg.
Phinho do Parana, *Araucaria brasiliensis* Loud	0.585	549
Sapucaia assù	1.001	730
» commun, *Lecythis Pisons* Cambess.	0.893	658
» mirim, *L. minor* Vell.	1.032	632
Tajuba	0.953	968
Tapinhoã, *Silvia Navalium* Fr. All.	0.997	693
Taruman	0.771	599
Ubatinga	1.054	859
Urindeùva	1.055	1 170
Vinhatico amarello, *Echyrospermum Balthazarii* Fr. All.	1.667	545

8 tanning, 6 colouring, 30 officinal, 6 gum and resin plants and 8 of distinct economic importance.

I. IV. — Besides the States of Amazonas and Para, those of Matto, Grosso, Bahia, Espirito Santo, Rio de Janeiro, Minas Geraes and Parana are also well stocked with valuable timber.

The most important are as follows :

Angico (*Piptadenia rigida* Benth.) : wood solid, compact ; heartwood red with dark spots : used for interior work, as it develops with a rapidity equal or even superior to that of eucalyptus, it is decidedly suitable for afforestation purposes.

Cedro (*Cedrela* sp.) female mahogany ; well known.

Canella (*Nectandra* spp.) compact, yellowish brown heartwood according to species ; used for building purposes.

Copaiba (*Copaifera officinalis* L.) heartwood deep red, very compact ; excellent for building and submerged constructions.

Jequitiba (rosa) (*Courataris legalis* Mart.) : heartwood rose red ; soft ; used for casing and boxes, one of the most beautiful species as regard shape, etc.

Jaca andá (*Dalbergia nigra* Fr. All), rosewood.

Páo Brasil (*Caesalpina* spp.) : Brazil or red wood ; used for hydraulic constructions ; dyewood.

Peroba (*Aspidosperma* spp.) : heartwood golden colour, compact and hard ; building, hydraulic and shipping : furniture.

Sapucaia (mirim) (*Lecythis minor* Vell.) : heartwood deep red and dark-veined ; very durable and excellent for sleepers.

Massaranduba (*Mimusops elata* Fr. All.) : heartwood red, very compact ; used for construction purposes ; homonymous similar to *Lucama procera*, Mart. ; the former indigenous to northern Brazil.

Sebastião di arruda (*Physocalymma floridum* Pohl) : compact ; very valuable for costly furniture ; price varies from 50 to 60 *milreis* per cu. metre.

V. VII. — The export of "pinho do Paranà" (*Araucaria brasiliensis* Loud) greatly increased during the war ; it replaces admirably the soft

coniferous wood framework cases, matches and ordinary forniture. It has been exported to Argentina and Uruguay since the cessation of the export of coniferous timber from other countries. The exports. to Argentina and Uruguay were as follows :

	Argentina	Uruguay
	metric tons	metric tons
1910.	1 222	1 192
1914.	4 884	1 953
1918.	102 680	49 341

Attention should also be drawn to the export of worked wood which amounted to 6568 and 9996 metric tons in 1917 and 1918 respectively ; the total export of wood was therefore 64 265 and 179 794 metric tons,

IV. — The area covered with forests in Brazil is 5 000 696 sq. km., representing 58.63 % of the total area.

Brazil is second in the world, coming next to Finland with regard to the area of forest land. The states which have the greatest extent of forests are Amazonas with 1 683 427 sq. km. (91.85 %), and Para with 921 954 sq. km. (65.57 %).

In 1913, the exports were, in order of value sent to the following countries : Argentina, Uruguay, United States, Portugal, France, and Great Britain. The total value of the exports increased from 1 358 730 paper milreis in 1913 to 6 330 514 in 1916. (1 paper *milreis* = 2*s* 3*d* at par).

VIII. IX. — Brazil owes its remarkable fertility to its ranifall (rain, dew, humidity), which is closely connected with the forest territory. It is judged necessary for Brazil to have a proportion of forest territory at the rate of 50 to 60 % in the equatorial zone, and 40 to 50 % in the tropical and sub-tropical zones.

XII. — Besides the control of forest utilisation re-afforestation and plantation schemes should be carried out, and in his last message to the national congress, Dr. E. Pessõa, President of the Brazilian Republic, emphasised the importance of preserving and re-establishing the woodland area of the Republic. Forest economy has proved that there exists in Brazil extraordinary wealth which can be utilised : Paper, resins, dyeing and tanning materials, furniture, building, posts, sleepers, and firewood. Moreover the export of timber for building and cabinets is a branch of commerce that requires development and re-ordination. There is an evident need for legislation with a view to the protection of this wealth by the establishment not only of forest rules and regulations, but also exploitation, extraction of medicinal plants and rubber, carefully avoiding unnecessary felling. What remains is to carry out the legislative measures already proposed as soon as possible, and thus provide Brazil with forest laws, similar to other civilised countries richly endowed with forest territory.

LIVE STOCK AND BREEDING

HYGIENE

774 – **The Toxic Effect of Peanut Cakes Containing Small Quantities of Castor Seeds.** — BRIOUX CH. and GUERBERT, M. in the *Comptes rendus des Séances de l'Academie d'Agriculture de France* Vol. VI, No. 17, pp. 449-454. Paris, May 5, 1920.

The Académie d'Agriculture has had its attention drawn, on several occasions to cakes containing *Ricinus*, which are responsible almost every year for producing very serious poisoning in cattle. In 1913, M. LE CONTE, a member of the Animal Husbandry Section, reported that a consignment of peanut cakes fed at the rate of 0.5 kg. per day to milch cows produced in his herd a number of abortions, one of which terminated fatally. On examining the suspected cakes, they were found to contain sufficient *Ricinus* to account for these misfortunes.

One of the authors had examined at the Rouen Agricultural Station, several samples of peanut cakes which had caused more or less serious cases of poisoning. In one case, some horses and cows were affected after a single meal; there was one fatal case among the horses, and lactation was suspended in one of the cows.

Microscopic examination of the suspected cake revealed the presence of *Ricinus* to the extent of 1.52 %.

A second sample, which was supposed to have poisoned 3 horses (one of them fatally) after being fed to them once in the proportion 800 to 900 gm. per head, was found to contain 2 % of *Ricinus*.

Some months later, a third sample which had produced more or less serious toxic symptoms in several horses, was found to contain about 1 % of *Ricinus*.

Thus very small quantities of *Ricinus* are sufficient to make a cake dangerous. The authors, quoting KOBERT, estimate that 3 gm of castor cake per 100 kg. live weight is sufficient to kill a calf.

In poisonous cakes containing *Ricinus* (which are almost exclusively peanut cakes) there is as a rule only a small percentage; the addition of so small an amount could be of no use from the point of view of adulteration. The presence of this dangerous substance, therefore, can only be regarded as accidental and due, in most cases, to carelessness, either in the cleaning of the apparatus (crusher or press), after using it for castor-seeds, or in the handling and transport of the peanuts and castor-seeds, which are often carried on the same vessels, as they frequently come from the same places.

Laboratory workers entrusted with the examination of suspected if cakes generally find that the samples only contain a minute proportion of castor cake.

Chemical analysis cannot reveal the presence of small quantities of ricine, the active principle of the castor-oil seed; therefore it is necessary to have recourse to microscopic examination. This gives good results, the work is done by an expert, provided the *Ricinus* accidentally introduced comes from undecorticated seeds, and if the cakes examined do not contain too large an amount of thick highly coloured cellulose which may more or less mask the fragments of castor seed shells, which together

with the cuticle, are the only characteristic portions of the seed that are easily distinguished in the mixture.

If 10 gm of suspected cake reduced to flour, is boiled for some minutes with a 2 % solution of caustic potash, it is possible by means of successive decantations, to concentrate into a small volume, the black angular fragments of the castor seed shells which are hard and very dense, and can be identified under the microscope. In a well decorticated peanut cake, it is easy to find by this method, 0.5 % of undecorticated castor cake, but it is imposible to detect even larger amounts, if the *Ricinus* has been accidentally introduced in the form of seeds or decorticated cake, for the kernel of the castor seed contains no tissues that are easily recognised in a mixture.

In such a case, recourse must be had to KOBERTS' useful biological method, which is based on the fact, that even infinitesimal amounts of ricine dissolved in a physiological salt solution have the power of agglutinating the red blood-corpuscles of mammals and birds.

There are a certain number of substances which, on being introduced into the blood are capable of producing the formation of an agglutinant substance causing the globules to adhere to one another. If the experiment is carried out *in vitro* upon globules in suspension in a salt solution the globules unite, adhere together, and soon form a clotted mass on the walls and at the bottom of the vessel and this is the phenomenon of agglunation. Ricine is an excellent agglutinin.

KOBERT, in his later works, suggested the use of blood corpuscles from the pigeon or guinea-pig, and the concentration of the ricine in suspected cakes by precipitating with alcohol the product obtained by macerating in water.

The authors, however, like KOBERT, have found that the agglutinant properties of ricine are rapidly altered, when left in contact with alcohol, therefore they also tried to find another simple method of concentration which is free from this disadvantage.

They found that ammonium sulphate, a substance that in concentrated solutions precipitates albumens, has also the power of precipitating ricine, without apparently alterating its agglutinating power, even after contact-lasting 24 hours. Instead of using like KOBERT, the red corpuscles of pigeons or guinea-pigs, the authors chose those of the rabbit. These corpuscles also agglutinate very easily, and the rabbit is an excellent animal for the experiment in question. It is enough to prick one of the superficial veins of its ear, in order to obtain without trouble, and without killing the animal, the minimum amount of blood (1 to 2 cc.) required.

The following are the outlines of the biological method suggested by the authors for the detection of castor seeds in suspected cakes:

A given quantity of the cake flour is macerated at 30° to 40° C in 5 times its weight of a 9 per 1000 salt solution, a few cc. of xylol being added to prevent any fermentation. After about 15 hours, it is filtered, and a portion of the filtrate (an amount corresponding to at least 10 gm. of

cake) is heated for an hour in a water-bath at 70° C, in order to destroy certain slightly resistant agglutinins that may be present in the peanuts. The mixture is again filtered to separate the coagulated albumens, and to the liquid thus obtainted, is added 50 % of its weight of pure, crystallised ammonium sulphate, which must be entirely dissolved, without raising the temperature above 40° C.

When the precipitate is formed, it is collected on a small smooth filter, thoroughly drained, and washed with just a few drops of distilled water to remove most of the ammonium sulphate ; then the precipitate is removed with a spatula from the filter, put into a small glass containing 5 cc. of physiological salt solution, stirred for a few moments, and re-filtered. The filtrate thus obtained, which is used in the final experiment, contains about 10 times more ricine than that from the first maceration. The rabbit corpuscles are prepared, after defibrination, by being washed, centrifuged and placed in 4 times their volume of a physiological salt solution.

The agglutination experiment is carried out as follows : The above-mentioned filtrate is mixed with a few drops of the corpuscle suspension in a small test-tube, and the tube is put into an autoclave kept at 37° C, which is a temperature favourable for agglutination. This takes place more rapidly the larger, the amount of *Ricinus* present in the groundnut cake. In the case of a cake with 2 % of *Ricinus*, agglutination is very clearly seen (using the authors' method) in 5 or 10 minutes, and the process is compete before the end of the first hour. With 0.5 % of *Ricinus*, agglutination is already perceptible after half an hour, but if the percentage is lower, it often does not take place until one hour has elapsed, but the method is sufficiently exact to allow of the detection of at least 0.2 % of castor oil seed cake.

It is a good plan to have a control tube filled with liquid from some macerated pure peanut cake that has been treated in exactly the same manner as the suspected sample.

This method of detecting ricine can apparently be easily and profitably used on all agricultural laboratories. It is a useful supplement to microscopic examination, which is frequently at fault, when it is a question of decorticated seeds, or when the histological interpretation is doubtful.

The method can only be employed with certainty in the case of peanuts but these are almost the only cakes in which the accidental presence of castor seeds occurs.

The authors, however, mention that KOBERT found in the common bean an agglutin which resists like that of *Ricinus* a temperature of 70°, C, and they themselves discovered a very active agglutin of the same kind in soya cakes. Therefore in the presence of a suspected cake sold in the form of flour, it is well to take into account these possible sources of error, although it is a very rare occurrence to find beans, or soya in peanut cake flour.

775 – **Myositis Produced in Cattle by Serious Attacks of Aphthic Fever, and Sanitary Measures Dealing with the Consumption of the Meat of Animals Affected by this Disease.** — I. Ronca, V. (*Istituto di Anatomia patologica veterinaria della R. Università di Modena*). Alterazioni e calcificazione nel miocardio dei bovini nelle epizoozie gravi di afta. *La clinica veterinaria*, Year XLIII, Nos. 5-6, pp. 145-163, figs. 2 bibliography of 22 publications . Milan, March, 1 and 31, 1920. — II. Squadrini, G. (Direttore del macello di Modena), Miosite aftosa con infiltrazione calcare, *Ibid.*, pp. 163-171, figs. 2.

I. Alterations and calcification in the myocardium of cattle in cases of serious outbreaks of epizootic aphthic fever. — During two epizootic outbreaks of exceptional severity that raged in 1912-1913 and in 1919, the author had occasion to examine numerous infected cattle, and found that, as regards affections of the feast, the most prevalent were parenchymatous alterations, that is to say, retrogressive processes taking place in the fibro-cells of the myocardium. Those most frequently observed in the muscle-cells were opaque degeneration, hyaline degeneration, and necrosis due to coagulation. All these heart affections were usually present at the same time . The more or less pronounced atrophy and disintegration of the contractile fibres were aso observed. The striation of the fibres, especially the transverse strial, either disappeared entirely, was little apparent, or incomplete. Very aften the heart showed yellowish or yellowish-white, dry, hard, and granular patches, or striations frequently containing large quantities of calcium salts, the product of calcareous infiltration and consisting, as far as can be determined by microchemical reactions, of calcium phosphate.

II. Aphthic myositis with calcareous infiltration. — In the case of 4.97 % of the cattle that have succumbed to malignant aphthic fever, a larger or smaller area of the striated muscles in the neighbourhood of the skeleton are found to be pathologically afiected. This is moie clearly seen in young than in old animals. The microscope reveals the presence of striae, or zones, differing in aspect and position according to their situation, and of a colour varying from yellowish to red. These symptoms reveal a form of myositis with vitreous, or waxy degeneration of the sarcoplasm, necrosis due to coagulation, and the subsequent infiltration of calcium salts, with more or less interstitial phlogistic infiltration.

According to the author, the possibility that aphthic fever may be accompanied by such serious symptoms of degeneration does not imply the necessity of modifying the sanitary measures now controlling the consumption of meat of animals affected by this disease (1). Before allowing such meat to be used for food, all the pathological and anatomical symptoms must be taken into account in each particular case. Muscles showing any degree of alteration of the above-described type will be condemned. Whether the other masses of muscle that have undergone no changes in appearance or organoleptic characters are to be condemned or put on the market at a low price, is a matter that will be decided according to the regulations hitherto in force.

(1) Regulations on this subject were issued by the Director-General of Public Health (Prof. Lutrario) in Circular No. 24310 of March 19, 1919. (*Ed*)

776 – **The Chicken Sticktight Flea (*Sarcopsylla gallinacea*.** — SANBORN, C. E., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Oklahoma, Bulletin* No. 123, pp. 3-8, figs 3, bibliogr. of 9 works. Stillwater, Feb. 1919.

Observations made for the use of farmers on the chicken sticktight flea (*Sarcopsylla gallinacea*) found in all the southern part of the United States. The parasite thrives best in an arid or semi-arid mild climate.

As a control measure the following are commended: (1) 5 or 10 % mixture of creosote with vaseline or lard; (2) 1 part carbolic acid + 5 parts vaseline; (3) 1 part kerosene + 2 parts lard. These 3 preparations should be applied to the infested parts. Four parts of zenolium in 100 parts water, sprayed in the poultry houses and yard, is also quite effective.

CATTLE

777 – **Cattle Fattening Experiment in South Africa.** — NOBBS, E. A. in *From Breeder to Butcher, Beef Feeding Experiment No. 6, Government Experiment Farm Gwebi, Bulletin* No. 338, pp. 1-12 Dept. of Agriculture. Salisbury, Dec., 1919

Previous experiments at the Government Farm, Gwebi, South Africa, have established the following facts:

(1) It is not profitable to fatten artificially the unimproved native cattle; only grade stock are worth feeding, and the higher graded they are the more profitable does the process appear.

(2) It is not profitable to stall feed cattle whilst pasture is abundant; it is better to let the stock graze until about May.

(3) Artificial fattening is only feasible between May and February.

(4) Complete stalling is preferable to grazing by day and stall feeding at night.

(5) The more quickly the animals are fattened the better; the duration of the fattening process should not in any case exceed 5 months; to this end feeding with concentrates is essential, but all the fodder crops should be grown on the farm.

(6) Under present conditions, it only pays to convert the cheaper forms of fodder and cheaper grades of grain into beef, as the finished article has to compete with pasture-fed meat, and the markets are not highly discriminating. Such comparatively costly products as oatcake, teff (*Eragrostis abyssinica*) and linseed are therefore to be avoided, and others such as beans, groundnuts, or mangels should be used sparingly as is consistent with securing a properly balanced diet.

(7) It does not appear advantageous to feed the class of grade stock now available till over 3 years of age. Younger stock is apt to suffer from teething troubles, and incline when forced, to grow in size and frame instead of adding flesh and fat. Possibly, high grade stock of early-maturing breeds may in time be profitably fattened at an earlier age than the grade now generally available.

(8) The relative advantages have yet to be tested of stall-feeding animals loose in a kraal or tied up individually in cribs, but experience points to the former as the better system.

(9) About 2 tons of well tramped manure, consisting of dung and litter may be reckoned upon from each beast during the process of fattening.

(10) To eliminate waste, it is advantageous to feed pigs with cattle (1 pig to 4 beasts), but if maize meal is used, not whole maize, then extra feed must be provided for the pigs.

After due consideration of these points if becomes a question between rapid forcing to fatten quickly on the one hand, and the use of the most economical foodstuffs which entails shower fattening, on the other hand. At the same time, only animals of suitable age to benefit by feeding, and yet not so young as to be wasteful feeders, should be selected. The principal aim of these experiments was to work out rations adapted to local conditions as regards seasons, foodstuffs available, class of stock obtainable, and markets ; the relative advantages of 3 aged and 4 year cattle for fattening purposes was also tested.

The stock used in these experiments consisted in 10 Shorthorns reared under ranching conditions, 5 of 3 years old and 5 aged 4. The fattening process covered a period of 133 days, divided into 3 stages during which the following daily rations were given per 1000 lb. live weight : (1) 9 lb. maize + 9 lb. of radisk, mangolds, pumpkin or majorda + 18 lb. of hay + 18 lb. silage ; (2) 7.5 lb. maize + 1 lb. groundnut meal + 1 lb. dhal meal (*Cajanus indicus*) + 7.5 lb. of succulents + 10 lb. velvet bean hay + 15 lb. each of silage and hay (these always fed *ad lb.*) ; (3) 6 lb. maize + 2 lb. dhal meal + 2 lb. groundnut meal + 1 lb. sunflower meal + 7.5 succulents + 15 lb. velvet bean hay + 15 lb. pasture hay.

For the 2 groups respectively the following results were obtained : Initial live weight : 970 and 1097 lb. ; final live weights at Gwebi, 1243 and 1353 lb. ; (2) after transport to Johannesburg 1175 and 1277 lb. ; dressed weight 686 and 786 lb. ; percentage dressing on Gwebi weight 55.1 and 58.1 %, on Joannesburg weight 58.3 and 61.3 %.

The figures for the 2 groups seem to be similar with regard to the daily average increase in live weight ; but the older animals, however, dressed on the average better than the others. All the animals were praised for their prime quality by the butchers. They were sold at Johannesburg at £25 each, and had been bought before fattening at £8 per head.

778 – **Comparison between Different Rations for Wintering Breeding Ewes.** — Russel, S. F., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station Bulletin* No. 125. pp. 2-8, figs. 2. Stillwater, July, 1919. SHEEP

The objects of the experiments reported in this Bulletin were : (1) To determine the comparative value of some Oklahoma feeds for wintering breeding ewes ; (2) to find the cost of wintering breeding ewes ; (3) to compare rations which contain silage with others that contain no silage ; (4) to compare cottonseed meal with alfalfa hay as a protein supplement ; (5) to compare ground kafir (sorghum variety) with kafir heads when combined with cottonseed meal and Sudan hay (*Sorghum exiguum*), Five lots of 20 ewes each were fed during 90 days, starting on January 4, 1918, to test the value of 5 different rations.

In two of these lots receiving 0.5 lb. of cottonseed meal per head and wheat straw with kafir silage (Lot II) and in another lot receiving cane fodder (Lot III), symptoms of cottonseed poisoining were noticed,

and 3 ewes died before the cottonseed meal could be replaced by bran. The effects on those fed with silage fodder were somewhat less serious. Two lots which had received half the quantity of cotton seed meal fed to the preceding lots, plus more kafir heads (Lot IV) or ground kafir grain, plus 2.03 lb. Sudan hay (Lot V) showed no ill effects and gave the maximum gain in size. The ground kafir seemed rather more satisfactory than the kafir heads. But, from the point of view of cost and health, the most economical ration proved to be that given to Lot I, in which 1.97 lb., of alfalfa per head furnished the necessary protein supplement to the kafir silage plus wheat straw. The following table summarises the results obtained:

Winter rations for breeding ewes.

	Lot I	Lot II	Lot III	Lot IV	Lot V
Numbes of ewes per lot	20	20*	20**	20	20
	lb.	lb.	lb.	ib.	lb.
Total initial weight . .	2015	2015	2016	2037	2015
Total final weight . .	2222	2024	2147	2307	2304
Total gain in weight .	207	9	131	270	289
Average daily gain per ewe	.11	.005	.072	.15	.16
Total feed consumed .					
Alfalfa	3554	—	—	—	—
Kafir silage	3289	5061	—	—	—
Wheat straw	1062	1244	.972	—	—
Cottonseed meal. . . .	—	—	828	444	445
Cane fodder.	—	—	4776	—	—
Sudan hay	—	—	—	3667	3663
Kafir heads.	—	—	—	1149	—
Ground kafir heads . .	—	—	—	—	758
Bran	—	450	210	—	—
Total cost of food. . .	$ 60.42	$ 54.18	$ 68.70	$ 73.13	$ 71.26
Average cost of food per head per day	.0335	.0301	.0381	.0406	.0395

* Two ewes died on the 75th day. ** One ewe died on the 85th day.

PIGS

779 – **Pig Breeding in Italy.** — STANGA, I., in *Giornale di Agricoltura della Domenica*, Year XXX, No. 20, pp. 155 and 158. Piacenza, May 16, 1920.

The three possible methods which can be employed in pig breeding are domestic, rural (i. e., transformation of farm by products), and industrial (i.e., transformation industrial of by products or rather constituting a distinct industry such as the raising of herds on pasture or on semi-housing lines). The first is much developed, the second has practically died out and the third could be very much improved and developed.

It can be said that, in Italy, the only improved breed used has been the large white Yorkshire, which produces a large amount of fat, but is difficult to breed in a country much warmer than its native land — the north of England. For this reason, the improvement of domestic stock

by the introduction of this breed has had no chance of developing on rural and industrial farms and these are much more important from the national and economic standpoint. The half breeds are weak, withs tand only with difficulty the sun from March to October, and are very subject to epidemic diseases.

The author agrees with the statements made by Prof. BALDASSARE to the effect that preference should especially be given to Berkshire pigs as stock for improving Italian breeds for industrial and rural purposes, and though the Berkshire admittedly gives less meat, that meat is proportionately, of better quality. Moreover, they are more hardy and easier to rear.

The author closes by remarking on the active steps taken by the U. S. Department of Agriculture with regard to agricultural propaganda, particularly as regards the development of pig breeding.

780 – **The Effect of Feeding with Peanuts on the Quality of Pork; Experiments in Oklahoma, U. S. A.** — DOWELL, C. T. and FRIEDEMANN, W. G., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Oklahoma, Bulletin* No. 124, Bibliogr. of 17 works. Stillwater, May, 1919.

The cultivation of peanuts has become quite general in the Southern United States, as has the pratice of fattening hogs on peanut pasture and cake (1). This method of fattening is more economical than using the common feed-stuffs, but the chief objection is that it is claimed that pork thus produced possesses a lower melting point (1) is soft and shows an excessive shrinkage. For this reason, prices for animals coming from districts where this form of foodstuff is used, are usually considerably reduced. The authors started their experiments with the object of finding some way by which the bad effects of feeding with groundnuts alone could be overcome. The iodine number and melting point were determined for the kidney and bacon fats of hogs weighing about 100 lb. each, used for experimental purposes in 1916 and 1918.

In 1916, 5 lots of hogs were fed for 70 days, and 1 hog per lot was reserved for a chemical study of the fats. In addition to this, at the Experimental Station, the shrinkage data were taken, during cold storage of 4 hams and of the bellies of one hog of each lot. The maximum iodine number, the minimum melting point, and a higher shrinkage percentage was reached in Lot I fed on peanuts alone. Two lots fed on peanuts for 40 days, followed by maize and tankage in the ratio 23 : 2 (Lot II), and another on kafir (a sorghum variety), and tankage in the ration 23 : 2 (Lot III) gave high iodine numbers, relatively low melting points and evident shrinkage was noticed.

The 2 other lots received no peanuts, and Lot IV was fed on oats + shorts + barley + buttermilk (1 : 1 : 2 : 8) and Lot V on maize chop + kafir chop + cottonseed meal + tankage (11 : 11 : 2 : 1). Better quality pork and lesser shrinkage signified the advantages of using the

(1) See *R.* Febr. 1920, No. 236. (*Ed.*)

last mentioned ration in the 1916 experiments. Table I shows the results of these experiments.

TABLE I. — *Results of Experiments in* 1916.

Lot No.	Shrinkage %		Iodine No. of fats		Melting pint of fat	
	For 4 hams	of bellies	of kidney Fat	of bacon fat	of kidney fat	of bacon fat
1	8.40	10.34	86.6	89.2	29.7	26.8
2	—	6.62	79.2	78.2	36.5	35.3
3	3.59	9.03	73.5	78.8	36.2	33.4
4	1.33	6.80	51.8	60.6	46.0	39.6
5	1.29	6.09	48.4	50.6	47.1	45.5

The 1918 trials included 6 lots each containing 8 hogs. Each lot received a small amount of alfalfa ; self feeders were used and the feeds were distributed in the following manner : I. maize + tankage ; II. darso (sorghum) + tankage ; II. kafir + tankage ; IV. kafir + peanut meal ; V. kafir + cottonseed meal ; VI. kafir + tankage + peanut meal + cottonseed meal. These lots are classified in order according to the average iodine number of back or kidney fat, and according to the increase in melting point except in the case of ot IV, which comes last but one on the list. Lot IV received a larger amount of peanut meal than Lot VI. The results are given in Table II.

TABLE II. — *Results of Experiments in* 1918.

Lot No.	Iodine No. of : —		Melting point of : —	
	bacon fat	kidney fat	bacon fat	kidney fat
1	70.94	63.18	37.9	41.1
2	67.70	62.88	39.8	43.2
3	65.49	61.06	39.9	44.1
4	63.53	59.01	38.2	41.5
5	60.44	56.84	42.6	44.5
6	58.14	54.51	44.3	46.0

POULTRY

781 – **The Pigeon as a Means of Increasing the Food Supply.** — BENEDETTI, I. in the *Giornale degli Allevatori*, Year XVI, No. 14, p. 108. Catania, May 20, 1920.

The author recommends pigeon-rearing for the rapid production of meat. The ordinary breed of pigeons should be chosen, for it is the most profitable, as from 20 to 24 young are produced annually.

Taking his own experiences in pigeon-breeding as a basis he calculates the profits of one financial year as follows :

INSTALLATION EXPENSES. — In order to set up a small pigeon-breeding establishment, it is necessary to have 100 pigeons ready for breeding 50 suitable breeding boxes ; 100 glazed earthen-ware nests ; 4 zinc syphon drinking troughs ; 8 special feeding-boxes to prevent the food being scattered or soiled ; boxes for ashes, rubbish, straw, etc ; other objects such as perches, apparatus for disinfection, small ladders, etc. ; the transformation of a room with an area of 5 × 4 metres and 3.80 m. in height, including the external cage into a pigeon loft; labour for putting in the boxes ; other expenses. At present prices, about 3000 francs would be necessary to cover the cost.

DEBIT ACCOUNT.

Repairs and renewal of material (5 % of capital)	150 fr
Rent of room used as pigeon-loft	50
Food of different kinds (grain and scraps from the table), 18 quintals, average cost 60 fr. per quintal	1 080
Cost of cleaning and disinfecting	300
Loss on sale breeders, 400 francs at the end of 4 years, or for the first year	100
Total	**1,680** fr

CREDIT ACCOUNT.

Sale of 1000 pigens at 2.50 fr. per pigeon	2 500 fr
Sale of 3 quintals of pigeon-dung at 15 fr	45
Total	**2,545** fr

PROFIT.

2545 — 1.680 fr. = **865** fr.

Which is at the rate of 28 % interest on the capital laid out.

If the pigeon-breeder had enough ground to permit of the pigeons going out of the loft every day, he could save about 500 francs on their food, and then the interest on the capital would amount to nearly 46 %.

782 – **Bee-Keeping in Corsica.** — BOURGEOIS, A., in *L'Apiculteur*, Year 62, Nos. 5-6, pp. 50-55, May-June, 1918 ; Nos. 9-10, pp. 102-105, September-October, 1918 ; Year 63, No. 1, pp. 19-21, January, 1919 ; No. 2, pp. 39-42, February, 1919 ; No 7. pp. 174-176 July, 1919 ; Year 64, No. 1, pp. 27-30, January, 1920. Paris. BEE-KEEPING

A description of the conditions of bee-keeping in Corsica together with information on the habits of bees, and methods of rearing them, founded upon the author's long experience of bee-keeping on a large scale.

THE CORSICAN BEE. — Bee-keeping in Corsica dates back to the most remote antiquity, but the methods employed there are still wholly empirical. There are a great number of hives (more than 15 000) on the mountains of the island, and 75 tons of honey, and 27 tons of wax are produced annually. Owing to natural selection, the Corsican bee is exceedingly hardy and active ; it answers all the requirements, of intensive breeding, and is superior to the selected bees on the market.

HONEY AND WAX. — Corsican honey is of very fine quality and aroma when it is collected in the spring ; the autumn honey has, however, a strong bitter taste, and is dark in colour.

The barbarous custom of suffocating the bees seems to be unknown in the island. The pre-war prices were from 1 fr. to 1.50 fr. per kg. for ordinary honey, and from 2 fr. to 2.50 fr. for choice kinds.

Corsican honey is in great commercial request, on account of its aroma and its whiteness. The pre-war price was from 3 fr. to 3.50 fr. per kg.

Resources of the Corsican Flora. — The bees can make honey for from 8 to 9 months of the year so that the season is very long. The honey- and pollen-producing plants of the various seasons include :

Winter and beginning of spring : Japanese medlar, hazel, willows, poplars, almond, apricot, peach, box, *rosemary*, mimosa, and maple.

Spring Cherry, wild plum, cultivated plum, quince, citrus, apple, pear, chestnut (this gives a reddish bitter honey, crystallising in large cristals), broad bean, kidney bean, lentil, peas, haricot bean, soya, cultivated aniseed, *sycamore*, *sainfoin* (abundant white honey, with a delicious flavour ; in good season, from 150 to 300 kg. of honey can be obtained annually from 1 hectare of sainfoins), black mulberry, white mulberry, asphodel, caper, evergreen oak, cork oak, Kermes oak, turnip, colza, cabbage, white mustard and nearly all the *wild Cruciferae* (the Cruciferae yield much honey which crystallises very quickly forming large crystals), lavender, and savory (a large quantity of very fine honey in some districts, none in others), banana, date-palm, Barbary fig (the fruit is used for making a bee-syrup), tamarisk, ash, wild geranium, orange tree, citron tree, lemon tree (these yield much honey where the soil is damp), *Trifolium pratense*, *T. incarnatum*, *white clover* (yields much white honey,) agave and aloe (a sweet syrup flows from their terminal bud, and is collected by the bees), vetch (all varieties of vetch, and especially the *hairy winter vetch*, yield large quantities of green honey which becomes white on keeping ; when the hairy vetch and sainfoin grow together, much very fine honey is obtained), cotton tree, dandelion (the pollen of this flower is believed to produce dysentery in bees, if they remain shut up for some days), and wild chicory.

Summer : Virginian sumach, still more the curriers' sumach, limes, especially the *silver lime* (yields much sweet honey with anodyne properties), ailanthus (much honey of an inferior quality) chestnut (honey of a common quality ; about 33 000 hectares are covered with chestnut in Corsica), tobacco (much honey of a brownish colour), lucerne (the last cutting give a little honey ; produces much honey on light irrigated soils, the honey is white, and has a delicate flavour), sage and viper's bugloss (much honey which crystallise slowly), *white melilot*, *Thymus vulgaris* and *T. Serpyllum* (a dark, very aromatic honey), bramble, spindletree, raspberry, whortleberry, eucalyptus and false pepper (much dark honey with a strong flavour), conifers (in addition to pollen and propolis, all conifers and the spruce in particular, produce in spring and especially in sum-

mer, so much nectar, that for 15 to 20 days, several kilograms of honey can be made daily by a colony of bees ; conifer honey is rich in glucose and resin, hence it is much used by doctors in treatment of affections of the bronchial tubes and lungs), Thuja, juniper, *Vitis Canadensis*, sorghum millet, maize, and reeds. At a height of about 1500 m., *Rhododendron ferrugineum* and *Rh. hirsutum* give much honey with a very delicate flavour.

Autumn : *Heather* (much light-coloured honey in summer, reddish and thick in autumn ; as it contains little, or no, saccharose, this honey never crystallises entirely), *buckwheat* (reddish honey, plantiful on argillaceo-calcareous soil, scarcely any or calcareous or heavy soil), mignonette, asclepia (much honey, but it may be injurious to the bees, as their legs adhere to it), *tree ivy* (white honey), *Arbutus*, *Japanese Sophora*, *carob-tree* (much reddish honey ; its fruit supplies a good bee-syrup), honeysuckle, and aster.

The plants whose names are printed in italics can, when numerous, supply sufficient honey to fill the hive in a few fine days. To do so, requires 2 or 3 hectares, of very melliferous plants per hive. The largest amount of nectar is produced on calcareous, or clay loam soils that are damp or irrigated.

NECTARS. — The herbaceous stalks of vetches, barley, and oats, the leaves and branches of the evergreen oak, willow, alder, aspen, ash, bramble, beech, hawthorn, juniper, orange, palm, maple, birch, agave, larch, eucalyptus, spruce, etc., secrete, under the influence of combined heat and cold, or as a result of the punctures of insects, a sugary matter which is at times very abundant. When hot days are followed by cold nights, or *vice-versa*, the plant nectar appears during the night and generally disappears in the early hours of the day. When they can obtain nothing better, the bees collect and store these nectars ; under favourable conditions, a colony of bees can collect 4 to 5 kg. daily and from 2 to 3 quintals in one season. There is always, in addition, a small amount of animal nectar due to the punctures and excrement of insect, which the bees sometimes collect. The presence of woods is therefore very advantageous to bees, especially in summer.

Extraction of Thick Honey. — Corsica produces some kinds of honey that are very thick and difficult to extract, in the centrifuge. This difficulty can be overcome to some extent by extracting the honey from the sections as soon as they are filled, and before they are entirely sealed up, but this is not always possible. The best plan is to prick both faces of the full cells to a depth of 8 mm. as soon as the combs are unsealed without, however, perforating the median wall of the cells, and then to have recourse to centrifugation ; the operation should be performed, if possible, in a room heated to from 30-35°C.

URINE AND BEE-KEEPING. — The nitrogenous substances supplied by pollen are often insufficient for the requirements of the bees, hence they visit pits of liquid manure and urinals, where they find the diastases or salts necessary for themselves and their brood. It is expecially

at the height of the laying season that the bees use urine both as food and drink. The author gives them, as a strengthening food, 3 or 4 kg. of honey diluted and carefully mixed with 1 litre of urine. As a tonic drink, he gives them two spoonfuls of honey dissolved in 3 or 4 litres of boiling water to which has been added 2 litres of urine.

Urine which has been slightly fermented by the addition of a little honey, attracts scout bees and afterwards the swarms. The author made use of this by placing in the vicinity of the apiary small hives of which the interior and combs had been sprinkled with urine.

Shading the Colonies of Bees. — This increases the yield by 20 % but all damp must be guarded against, as it is very injurious to the health of the bees.

Hive Management in Bad Season. — In order to prevent scarcity of honey, treatises on beekeeping advise feeding the bees on sugar. The author, however, considers this is wrong, both from the hygienic and economic standpoint. He advises that as soon as the bee-keeper finds that the first spring harvest is deficient, he should stop increasing the apiary remove the store-houses already placed, and reduce the brood chamber to the number of combs that the bees can use for food. Later, it might be possible and wise to increase the apiary in time for the small summer and autumn harvests. This method obviates the necessity, in bad years of feeding the bees during the winter.

Extracting Honey without a Laboratory. — The honey should be collected during the day, and the full combs placed in well-fitting boxes provided with a door which opens only outwards. This permits of the escape of any bees that may be still in the combs. At nightfall, the honey is extracted at a certain distance from the apiary. It is filtered, placed in vessels, and carried immediately to the store-room. All the utensils must be well-washed, in order to remove every trace of honey, so that the bees when they return next morning, perceive nothing, and are not upset.

Economical Concentration of the Productive Forces. — The old fashioned-basket can still be of great use in bee-keeping, and is the best means of insuring the economical increase of the bees. The writer advises the following method:

Place 2 baskets, one to the right and one to the left of a hive provided with frames, and tenanted by active working bees. The 3 colonies will thus have one flight-board in common, and will be close together, which will facilitate later work. As soon as the bees show signs of having reached the height of their honey-making, transfer the contents of the hive with frames to a new box, with the exception of 5 or 6 combs, which should be left for the brood; this will prevent too early swarming, and will give rise to feverish activity. The same day or the day after, when many of the bees are out collecting honey, a second hive flanked by empty baskets should be placed on the top of the first one, the two first baskets being removed. The progress of the honey-making must be watched, the number of receptacles increased, if necessary, and finally the honey is taken. This system is better than any other, in countries where the honey har-

vest is large, and the season short, but does not succeed where there is little honey and the collecting season is long. The advantages of the method advocated by the author is shown by the following figures: One hive fitted with frames and treated in the usual manner produces on an average 15 kg. of honey the 2. baskets furnishing 10 kg., whereas by the systematic concentration of honey-makers, the production is doubled.

Hives fitted with frames can also be used for the economic increase of the bees; the most pratical are twin hives and the method to be employed is the following: As soon as a numbers of bees have gone out, take a swarm from the turn hive, and put it in another hive, replacing the swarm by honey-combs.

Purchase of Ordinary Hives. — The ordinary Corsican hive is usually made of the bark of the cork-oak, or else of plaited twigs, or straw. The author advises the bee-keeper to buy hives with a gross weight of from 20 to 25 kg., but never to purchase those weighing less than 15 kg. (10 kg. of honey and 5 kg. of bees). The price of natural swarms varies from 2.50 to 3 fr.; that of the mother-colonies from 6 to 12 fr. each.

The second part of this article, which is devoted to pastoral bee-keeping in Corsica, contains the following chapters: Pastoral apiculture; the advantages of pastoral apiculture; the situation of the apiary; places to be avoided; the aeration of hives during transport; packing hives transporting bees, unloading hives on arrival; opening the small door; orientation of the honey-gathering bees; treatment of colonies of which the combs have been broken; cost and yield of a Corsican pastoral apiary. This is calculated on the following manner.

Cost and Yield of Corsican Pastoral Apiary.

INSTALLATION EXPENSES

Purchase of 1000 pastoral hives at 14 fr.	14.000 fr.
Cost of bees	5.000
Cost of materials and wood-work	2.500
Cost of curtains and huts	2.500
Studies.	1.000
Total	**25.000** fr.

ANNUAL EXPENSES

Rent of ground for apiary.	1.000 fr.
Transport or change of place	2.000
Interest and depreciation	6.000
Payments to bee-keeper and assistants.	8.000
Total	**17.000** fr.

ANNUAL EXPENSES OF RETAIL SALES

Rent of shop	1.500 fr.
Management	1.800
Licence, lighting, insurance, various expenses	1.200
Advertising.	5.000
Total	**9.500** fr.

SALES OF PRODUCTS	
1000 colonies at 30 kg. per hive, or 30.000 kg. of which 15.000 kg. are of superfine honey at 2 fr. per kg.	20.000 fr.
15.000 kg. of ordinary honey, or made into confectionery, at 1.50 fr. per kg.	22.500
500 kg. of wax at 3.50 fr. per kg.	17.500
Total	**24.250** fr.
BALANCE: Total sale of products.	54.250 fr.
Cost of production and sale	26.500
Net annual profit.	**27.750 fr.**

783 – **Bee-keeping in Macedonia and Chalcis.** – TABUSIEAU, H., in *L'Apiculteur*, Year 62, Nos. 3-4, pp. 35-38, 3 fig. Paris, March-April, 1918.

In Macedonia and Chalcis, bee-hives are seen everywhere, but there are no extensive bee-farms where bees are kept on a large scale. The peasant merely has, hidden behind the low wall of his garden, a few hives, and the honey produced is mainly intended for domestic consumption. The only large apiary in the country is that belonging to the Sédès Agricultural College. Bee-keeping however, is carried on in the numerous monasteries on mount Athos.

In the apiary of the Sédès Agricultural College, most of the hives are of the old Dadant type, but there are also some Dadan-Blatt, Layens, and Root hives. The hives with fixed combs are those generally used; they are cylindical, 50 cm. in height, and 25 cm. in diameter.

The black breed of bees is the one kept; it is very gentle, and a hive of these bees in full work can be uncovered without any risk of being stung.

The nectar is chiefly collected in spring and summer from the fine *Labiatae* growing on the mountains. If the nectar is rare, the honey, however, is delicious. White melilot grows plentifully in marshy localities. *Erica multiflora* abounds in many mountainous districts.

784 – **Bee-keeping in Ethiopia.** — Frère JULIEN de MAMERS (Capucin, Apostolic Missionary), in *L'Apiculteur*, Year 61, Nos. 1-2, pp. 2-4, Jan.-Feb., 1917; Nos. 3-4, pp. 38-42, fig., 2 March-April, 1917; Nos. 7-8, pp. 101-103, July-August, 1917; Nos. 9-10, pp. 128-134, fig., 3 Sept.-Oct., 1917; Year 62, Nos 1-2, pp. 4-9, Feb., 1918; Nos. 7-8, pp. 74-80, 2 fig., Feb., 1918; Year 63, No. 1, Jan., 1919; No. 2, pp. 12-18, pp. 35-39, Feb., 1919; No. 4, pp. 82-89, April, 1919. Paris.

Swarms of bees are common in the forests of Ethiopia; the combs are taken in the most crude manner, not only by the natives, but also by hunters and explorers. Honey is one of the chief dues paid to landowners, administrators, and chiefs. It is much used as an article of food and the natives employ it as a medicine, as well as in the preparation of hydromel, their national beverage. About 90 % of the honey produced is made into hydromel.

The author estimates the number of hives in Ethiopia at about one million. Some 700 tons of wax are exported annually, and in addi-

tion, a certain amount is used in the country for lighting the houses of the rich, and in the churches, but it may be calculated that about half the wax obtained is thrown away by the natives, who are wholly ignorant of its value. The average annual honey yield may calculated at 10 kg. per hive ; no honey is exported. The Imperial Palace alone uses every year 210 tons of honey for the manufacture of hydromel.

The native hive is cylindrical, from 20 to 35 cm. in diameter, and from 50 to 120 cm. high. It is made of wood, wickerwork, bark, or sun-dried mud, and is always covered with straw, and provided with a movable bottom or with simple plugs of straw at the two extremities. The hive is suspended in such a manner that the long axis is horizontal (in this way, the combs are parallel to the cylindrical walls); the flight-holes are placed in the centre, or at one extremity of the cylinder. The hives are always hung some metres above the ground, usually at a height of from 6-8 metres, though sometimes at as much as 12 to 15 metres.

The apiaries near the houses only consist of a few hives, but in the woods on the mountains, there are sometimes as many as 40 or 50 per family, so that one may say for instance, that in the great virgin forest of the Gougou Chain, which covers from 20 000 to 25 000 sq. km., there is not a single tree without its hive. By suspending a hive to a tree, the bee-keeper becomes the exclusive possessor of the tree and no one may fell it, or attach another hive to it.

Natural swarms occur very frequently, for the natives gather the honey so rapaciously that the famished bees are obliged to seek a new home If an empty hive is suspended from a tree, 8 times out of 10 it will be occupied without further trouble by one of these swarms.

The author has found that wandering swarms are attracted by the buzzing of another swarm, and also by the smell of hot wax. A good way of enticing them is to place in the sun some light, small hives whose inner walls are covered with liquid wax ; this melts and emits a strong odour, which is soon perceived by the bees.

The domestic bee is *Apis fasciata*, the same species as that kept in Arabia and on the shores of the Rred Sea. It is somewhat smaller than *Apis mellifica*, and very productive, but so bad-tempered when in another country, that all breeders that have tried it have given it up. Smoke has no effect upon this bee, so the hives have to be handled at night, and the bee-keeper is obliged to use every means of protecting himself while at work. The domestic bees include 2 varieties, known respectively as the black bee, and the red bee ; the former predominates at altitudes varying from 1200 to 3000 metres, the latter in the low districts, and to the height of 1200 m. The maximum of production was attained by an early swarm, taken in September which, 6 months later, had filled a hive with a capacity of 189 cu dm. During this time, the bees had made 36 combs ; when the honey was taken, 18 of the combs yielded a total of 70 kg. of honey, the other 18 being still occupied by the larvae. The average production depends upon the usual size of the hive. In order to ensure

the development of the bees, and prevent swarming, 64 cu. dcm. are reserved for the brood, and 21 cu. dm. for the honey.

The author quotes same observations that he and his fellow bee-keepers have made upon the nuptial flight of bees. All the 4 queen bees observed made 3, 5 and even as many as 7 flights, and all the queens were fertilised twice. They left the hive at 2 p. m. (not at midday, as is generally reported). One of the queen bees only, began to lay 36 hours after fertilisation.

In addition to the domestic bee, there are several wild varieties that are stingless. One of these, a very small insect, belonging perhaps to the genus *Trigona*, produces a honey which is more liquid than that made by the ordinary bee, and is much prized for its medicinal qualities.

At Addis-Ababa, where the author has his apiary, there are 2 seasons: the rainy season lasting from May to September and the dry season, which comprises the rest of the year. During the rainy season, the temperature is warm, varying from a maximum of 25° C to a minimum of 14° C. At this time, the bees are out all day looking for flowers which, however, are non-existent. Their daily exit from the hive throught the year has several disadvantages, of which the chief is the larger consumption of honey, as this entails a diminished honey harvest. Throughout the dry season, the temperature varies during the day between —3° C and 25° C; it is about 14° C in the morning and evening. Given the lack of moisture, very little nectar is secreted, and little honey is made. There are, however, 3 kinds made from the flowers of the natural meadows the various species of eucalyptus, and as shrub of the genus *Eupatorium* known by the name of " garaivo ".

The honey-collecting season usually lasts from the middle of September to the end of February. The average annual yield of a native hive situated in a fairly good honey district varies from 8 to 10 kg. The apiary belonging to the Catholic Mission (the only one in Abyssinia which has hives with movable frames) yields, on an average, 26 kg. of honey annually.

Bees in Ethiopia have numerous enemies, of which the most formidable is the ant-eater, known as " hama " (the " wicked one "). The natives, suspend their hives from trees for the express purpose of protecting them from the attacks of this greedy mammal, and this makes the operation of taking the honey a very difficult one, for on account of the bad temper of the Abyssinian bee, it has to be carried out at night.

Ants are other enemies of the bees. There are two kinds, the small red variety, similar to that found in Europe, which can easily be driven away by scattering a few ashes round the hives, and the large black variety, which does far more mischief. When the weather changes, these black ants come out of their nests in great swarms, invade houses and destroy insects, rats, and even fowls, young pigs, etc. It seems impossible to bar their progress by the use of the remedies used successfully in the case of the common ants (ashes, carbolic acid, a streak of oil, etc.). Naphthaline is the only thing which they dislike enough to refuse to face it.

A certain amount of destruction is wrought among the bees by birds. The honey-comb moth does as much damage in Abyssinia as in Europe.

In conclusion, the author describes the native method of making several kinds of hydromel.

785 – **Standard External Measurements and Rigidity of Bee-Hive Frames.** — E. and A. FROMENT, in *L'Apiculteur*, Year 64, No. 5, pp. 105-109, fig. 3. Paris, May, 1920.

I. — *Standard external measurement for bee-hive frames.* — If a hive with movable frames gives too much room for the passage of the working bees, the latter build; if there is too little space, they make propolis.

In order to prevent both these equally serious evils, the authors after comparing notes with other bee-keepers, decided to reduce the passages to a minimum, and to provide a way for the bees underneath the frames, by means of a strip of metal that raises the latter 5 mm., above the bottom of the rebate.

It would, however, be of general advantage if the same external measurements were adopted for all frames. This would make them interchangeable, and the same frames could be used for all types of hive, thereby greatly reducing the trouble of handling them. Therefore the authors urge bee-keepers to obtain, by means of propaganda and their united efforts the general adoption of standard external frame measurements.

II. — *The rigidity of the frames.* — The want of rigidity in bee-hive frames is a source of much inconvenience. In the case of a Dadant-Blatt frame 27 × 42 cm. with uprights 0.7 cm. thick, a slight pressure is sufficient to show that it has no lateral rigidity. The same may be said of all frames with uprights less than 1 cm. in thickness. With uprights of this thickness, however, the authors, obtained the required rigidity. Further, there was no necessity to fasten the frame above by means of *U* shaped nails, and it was possible, without bending the reprights, to attach the wires of the honey-comb wax, as M. DADANT recommends. The first can be fixed about 6 cm. from the top of the frame, the second at a distance of 14 cm., and the last at 24 cm. This arrangement obviates all risk of the wax losing its shape from the heat, or the weight of the bees (especially when new swarms are being introduced into the hive). The great difference in the thickness of the nails used in fixing a 1 cm. upright is also to be noticed. With frames of this type, the authors obtained perfect lateral rigidity.

According to this principle, the measurements of the frames (in mm.) would be respectively as follows:

For the LAYENS type: 330 × 370 interior; 330 + (2 × 10) = 350 by 370 + 15 + 10 = 395 exterior.

For the DADANT-BLATT type: 420 × 270 interior; 420 + (2 × 10) = 440 by 270 + 15 + 10 = 295 exterior.

For the VOIRNOT type: 330 × 330 interior; 330 + (2 × 10) = 350 by 330 + 15 + 10 = 355 exterior.

SERICULTURE

786 – **Eggs Intermediate in Type between the Summer and Winter Eggs Produced by *Bombyx mori*.** — LÉCAILLON, in *Comptes rendus de l'Académie des Sciences*, Vol. XLXX, No. 18, pp. 1085-1086. Paris, May 3, 1920.

As a general rule, the eggs laid each time by the different varieties of the mulberry Bombyx are either all summer eggs, or all winter eggs.

In exceptional cases, mentioned later in the article, a special type of egg is laid differing in various degrees from the two normal classes. Its colour, when first laid, is nearer that of the summer than of the winter egg. Some of these eggs, after assuming a pink colour, hatch out at the end of 10 days exactly like summer eggs. Others laid at the same time, become pink, but remain at a very rudimentary stage of development, not hatching out till the following spring that is to say, much later. The latter thus resemble summer eggs in some respects (initial colour and subsequent colour changes), whereas in another (duration of embryonic stage), they are more like winter eggs. It should be added that, in the same laying, some eggs are often found that are more highly coloured than summer eggs, both when first laid, and also at the time when they cease their development in order to prepare for wintering. These eggs very closely resemble the true winter eggs.

The larvae from this intermediate type of egg can sometimes be reared as easily as normal silkworms, but very often they die, in spite of all the care bestowed upon them. On the whole, they seem less well adapted to ordinary silkworm-breeding conditions than normal individuals.

It is well-known that the mulberry Bombyx manifests great variability in many of its specific (?) characters. That this depends upon difference in the chemical composition of eggs produced by the same ovary is clearly shown by the case of the intermediate eggs in question.

The author has previously drawn attention to the fact that the appearance of a supplementary generation in a hitherto univoltin breed is due to a change in the chemical composition of the egg (accidental bivoltism). The facts set forth in the present paper clearly support this theory, and, further, prove the truth of another conclusion arrived at by the author, who does not regard the appearance of accidental bivoltins in a univoltin Bombyx breed as due to a mutation in DE VRIES'S sense of the word. The composition of the intermediate eggs of the same laying is found to vary by imperceptible degrees.

The cases in which the author has seen intermediate eggs produced are as follows.

(1) Where the females were directly descended from accidental bivoltins (1).

(2) Where the females themselves came from intermediae eggs.

(3) Where the females were the descendants of hybrids of the first generation obtained by crossing a male univoltin with a female polyvoltin from China.

(1) For information on accidental bivoltins, see *R.*, Jan., 1918, No. 75. (*Ed.*)

787 – **Tussore Silk** (1). — FUSCHINI, C. (R. Istituto superiore agrario di Perugia), in I. I. I., *Rassegna della Produzione italiana, Numero specialmente dedicato alle Industrie tessili, manfatturiere, chimiche, minerarie ed edilizie*, Year IV, General Series, No. 24. Section C., No. 6, pp. 19-20, figs 3 Milan, June, 1920.

The silks sold under the name of « tussore » come from the cocoons of many kinds of silk-producing *Lepidoptera*, of which some Asiatic genera alone deserve mention, on account of the importance of their product, viz., *Philosamia*, *Antheraea* (the chief,) and *Theophila*. The species of *Theophila* which yields silk is *T. mandarina* (in Chinese " tién-seng-tsan "), which is considered by some persons to be the ancestor of *Bombyx mori* and, on account of its pale straw colour, is known by the name of " *tussah cloude* ". This silk is very rarely exported as the whole output is generally used locally. Among the Italian species, *Saturnia pyri*, or the " great peacock ", produces a large pyriform cocoon composed of coarse silk with little strength; it is of the same type as the cocoons supplying tussore silk.

The tussore silk of the Italian market is exclusively of Chinese origin, and is made from the cocoons of *Antheraea pernyi*. The silk-worm of this moth lives on several kinds of smooth-leaved oak, but will also eat the leaves of the apple-tree, hawthorn, chestnut, etc. In Manchuria and Shantung, it is also fed on the leaves of *Cudrania triloba*, and it appears that worms thus reared produce the finest silk.

The standard of the tussore silk made from the cocoons of *A. pernyi* is about double that made from the cocoons of the Italian mulberry Bombyx, its resistance is usually above 3.50 gr. per *denier* (a denier = 0,05 gr.); it loses from 17 to 18 ¼ when degummed. If special precautions are taken, the silk is easily wound off the cocoon.

A. yamamai (Japanese word meaning " worm of the mountains ") lives on oaks, preferably on *Quercus serrata*; it furnishes the Japanese " tussah " silk, which is of a pale green colour and very glossy. Little of this silk is exported, as most of it is consumed locally. The raw silk, like the product of nearly all silk-producing *Lepidoptera*, is much striated; its standard is nearly double that of the Italian silkworm, and its resistance is about 3 gm. per *denier*. It contains about 20 % of sericine; 1 kg. of dry cocoons contains about 700 gm. of chrysalides.

There are also other less important species, such as: *Philosamia arrindia*, which lives on the castor-oil plant; the cocoons, especially in Assam, are wound on the spot, and the silk is used locally; *Philosamia cynthia*, this species is also acclimatised in Italy and is sometimes found (especially in the district of Verbano), on *Ailanthus glandulosa*; its cocoon is smaller than those of the preceding species, and can be wound, though it is better carded. This silk furnishes a tussore of inferior quality to that obtained from the former species. Several attempts have been made to acclimatise these species in Europe and varying results have been obtained. Much of the lack of success was due to the fact that these insects,

(1) See *R.*, September, 1912, No. 1331. (*Ed.*)

which are a prey to many parasites, were regarded as more hardy than they really are. As the mulberry Bombyx flourishes nearly everywhere in Italy, and its silk is of superior quality, the rearing of the tussore silk species will be restricted to those limited zones where, as the Bombyx is a failure, some substitute for it must be found.

RURAL ECONOMICS

RURAL ECONOMICS

788 – **The Value of Fruit Trees.** — I. DELAUNY, L. in *La Vie à la Campagne*, Vol. XVI, No. 194, p. 181. Paris, August, 1920. — II. BRETON-BONNARD, L., in *Le Jardin*, Year XXXIII, No. 720, p. 360. Paris, Sept. 20, 1919. — III. LECOLIER, P., in *La Vie Agricole et Rurale*, Year IX, No. 47, pp. 384-386. Paris, Nov. 22, 1919.

The question of the valuation of fruit trees is of the first improtance, particularly at the present moment when so many people, ruined by the war, have to be compensated for the damage caused to their property by projectiles, poisonous gases, etc., and for the systematic destruction of orchards by the Germans during their retreat.

The following method of valuation was arrived at after a survey of the devastated regions of Northern France. In this method the tree must be considered from the time it was planted until it was destroyed, and its value fixed without taking as a principal basis the relation between the interest represented by the produce of the tree and the capital constituted by the tree itself, although these factors are taken into account to a certain extent; The value of the tree at the time of planting is represented by its cost price at the nursery, plus the cost of transport and planting, to which must be added the depreciation of the material necessary to the upkeep of the plantation and a percentage for insurance against unsuccessful planting.

During the year after it is planted the tree merely strikes its roots afresh. In the second year it begins to grow ; its branches lengthen and ramify ; it increases in strength and size, and acquires a plus-value which augments yearly. If, therefore, it is possible to determine exactly this annual plus-value with its various elements the problem can be solved.

Whether it be a question of young trees or trees in full bearing this plusvalue is divided as follows :

(1) The natural plus-value or plus-value of growth., (2) the plus value of maintenance, represented by the cost of cultivation, rent, ground occupied, material employed, etc., and (3) the future value. When once the tree is planted it grows in height and bulk even if it is not attended to ; it is this growth that the author designates as natural plus-value. Secondly, the cost of the cultivation of the ground, including tillage, hoeing, manuring, the care of the tree, pruning, staking, spraying, etc., can be estimated, and this annual estimate, added to the annual natural plus-value gives the approximate annual total plus-value. To the sum thus arrived at must be added a discount of so much per cent. representing the future value, or a kind of assurance premium against the risk of destruction of the capital represented by the tree in question. Calculating in this

manner rather than by the relationship between capital and interest, the field of discussion is narrowed and, consequently, it is easier to arrive rapidly at an understanding. This method will be adopted in every case that presents itself, whether orchards or pleasure gardens.

STANDARD FRUIT-TREES. — The most usual orchards are those stocked with standards:— pear, apple, cherry, plum, walnut trees, etc.

Let us suppose that a standard fruit-tree costs, together with the buying price and transport, the sum of 4 fr. (naturally the actual price of purchase is taken), and that it has been planted without further expense. To this figure should be added that of the percentage of assurance, which is valued at 10 %. The tree therefore is worth, before it is planted, 5.50 fr. The cost of planting consists of the preparation of the hole, the application of manure, the " dressing " (habillage) of the roots and top, " pralinage " (i. e., plunging the root system of the tree for a few seconds in a mixture made of clay, fertiliser and water), and the filling up of the hole; to this must be added the rent of the ground occupied, the reserve fund for tools necessary for the whole plantation and the cost of fertilisers. The whole, may be estimated at 5.50 fr. + 1.50 fr. = 7 fr., a figure which will remain unchanged until the end of the first year.

In the second year, it may be estimated that the annual plus-value of the tree will comprise: (1) The natural or growth plus-value fixed at 2 fr.; 2) the cost of up-keep of the ground and tree, hoeing, manuring, pruning staking, spraying, liming, to which must be added the cost of upkeep of tools and the rent of the ground; the cost of cultivation may vary, but it can be estimated at 2 fr.; (3) an insurance against any accident that might happen to the tree sufficient to cover its future value, either for instance, ¼ of the sum of the first two items or the sum of 1 fr. The annual plus-value is therefore 5 fr., and at the end of the second year the tree is worth 7 + 5 = 12 fr. This plus-value cannot be estimated in this way until the end of the tree's existence; at a given moment it should begin to decrease, finally disappearing.

PRODUCTIVE VALUE. — In arriving at these figures the real age of the tree is not taken into account, but is only the period that has elapsed since it was finally planted, the years spent in the nursery being included in the purchase price. The tree continues to grow vigorously until an age that may be fixed at 25 years, it is then worth the value of the first year, 7 fr. + 120 fr. (24 times the plus-value of 5 fr.).

At this period of its existence the tree does not remain stationary: it grows stronger, its branches ramify, and, consequently, its productive powers increase.

Its plus-value must then be lessened to the extent of the premium on its future value (which is no longer necessary, its full value bing attained), and, as it is now fully developed, and requires less care, the plus-value may be estimated at 2 fr., including the rent of the ground. It is admitted that a fruit-tree makes little progress after it has been planted for 40 years. The plus-value of 2 fr. can be estimated up to this point, the value of the tree being then computed as follows: Value at 25 years old, 127 fr.

+ 30 fr. (15 times the plus-value of 2 fr.) = 157 fr. Its productive powers, and, consequently, its value will be stabilised from this age onwards until its regularly decreasing yield shows that the period of deterioration has begun. It would then be necessary to estimate the tree at an annual minus-value were there not another factor to be considered, namely the industrial value of the wood. The tree has grown in height and bulk, its principal branches and trunk have attained a considerable diameter and the wood has hardened and is in demand for the wood industry. It is therefore logical to estimate the value of a tree that has been destroyed at its highest value, either industrial or productive as the case may be. Notaries, auctioneers and timber merchants whose business it is to buy and sell trees as they stand, are able to fix the exact industrial value of a tree in accordance with current prices. The figures indicated above, although varying in different districts according to the species and varieties of the trees and their production (fruit destined for the table or the press), may be regarded as average. It may be accepted that a tree which has been planted for 40 or more years, represents a productive value of from 150 to 160 fr., its industrial value varying with its size from that price onwards.

II. — The following, according to the author, is the value of fruit trees as estimated by State experts:

Standard apple, pear, plum, apricot, cherry and walnut trees:

Plantation, 2.50 fr. + 1 fr. yearly (including 4 years in the nursery) for 35 years.

From 36 to 60 years: 2 additional francs yearly, the tree being then in its prime if it has been attended to and the ground is good.

After 60 years the period of decay sets in, and the value of the tree decreases by 2 fr. yearly during 20 years for apple and pear trees.

After 80 years, pear and apple trees are of no value except as firewood.

The stone fruit trees (plum, cherry, apricot) only bear for 30 years. The produce of the walnut tree, however, may be counted for 100 years, at 2 fr. yearly from the 35th year, except in cases of accident. Anyone, therefore, who is concerned can easily, with these data, draw up a table and estimate the value of the damaged trees.

Trees whose bark has to any great extent been gnawed by horses are considered as destroyed.

For dessert apple and pear trees an increase in the value of 10 % is quite allowable.

For pruned garden trees each expert has his own tariff. The following one is for trees in good condition:

Pyramids, Standards, Bush, Cordons: value of saplings taken from the nursery, 1 fr.

Pyramids, Espaliers, Bush, already in cultivation: from 2 years, 2 fr.; from 3 years 3,50 fr.; from 4 years, 5 fr.; add 1 fr. per tree for transport and planting. Pruning, labour, ground occupied, etc., add to its value.

In this way the following figures are arrived at, varying with the successful growth of the tree.

Years	Standard and Bush	Espaliers	Cordons
	fr.	fr.	fr.
2.	3.50	3.50	2.00
3.	5.00	5.00	3.00
4.	6.50	6.50	4.00
5.	7.75	7.50	5.00
6.	9.00	8.00	6.00
7.	10.50	10.00	7.00
8.	12.25	11.50	8.50
9.	14.00	12.00	10.00
10.	16.45	14.00	11.50

This applies to pear trees grafted on quince trees and to apple trees. Ungrafted pear trees which are very fine trees, may increase in value up to 20 years in the same proportions ; the beauty of the tree its fertility, the ground where it grows, may all affect its value more or less, but the commissioners will probably keep to the regular tariff which alone can enable them to work and justify their decision.

III. — According to the method described above, the value of a tree increases yearly by 1 fr. up to 35 years, then by 2 fr. from 36 to 60 years, afterwards decreasing yearly by 2 fr. up to 80 years, when the sole value of the tree consists in that of the wood. It is evident that, calculating thus, the matter is a simple one, but generally speaking this calculation is false, for the value is purely mathemical. The scale may be carefully graduated, but it applies to both productive and unproductive trees, and the latter cannot have the same value. A method of valuation cannot be precise or mathematical without creating errors. But factors of valuation exist, which serve as a basis for calculation, and enable us to reach an approximate figure. This has been investigated by the author for several years and the results constitute a further method. Every tree has its own individual value, according to the conditions of plantation in a given district, in a more or less suitable soil, in a form more or less variable. These factors must be estimated on the spot when taking into consideration the age of the tree and the "yield" which constitutes its value. Thus the examples given by the author cannot serve as a universal ready reckoner, but they illustrate his method, and the table given at the end of this article, are used for purposes of comparison. The use of given formula will always be easy in special cases and thus will be of great value to experts.

The fruit tree represents capital because it is a source of income. The income being variable the capital outlay represents the cost of the tree when purchased plus annual expenses such as rent, manuring, labour, etc. When the tree bears fruit the capital outlay becomes productive capital. The value of the tree is all the greater if it bears well and its fruit fetches a good price ; the basis of the method therefore is the yield, and if the tree is not productive its value is reduced to that of firewood. The author has worked out formulæ which can be applied to all conditions of production. V or value $= C\,O$ or capital outlay up to the period of pro-

duction. To discover the $C\,O$ the A or cost price must be ascertained plus the cost of planting, etc., B or annual expenses multiplied by the age from plantation. $C\,O = A + B$. The formula of valuation of a tree still in the period of capital outlay, will be: $V = C\,O$ or $A + B$. As soon as the tree becomes self supporting i. e., when its yield covers the annual expenses, it becomes productive capital, $P\,C$, and $V = P\,C$. To find this $P.\,C.$ we must ascertain: r or average value of the yield; f or average cost of production; R or net income from the crop which can be obtained by subtracting f from r. Capitalising at the rate t, say at 5 %. The net income obtained, the formula of valuation of a tree in the period of productive capital will be $V = P\,C$ or $\frac{100 \times R.}{t}$

We know that this productive capital does not last for ever; the tree is destined to disappear; its life is limited. It is therefore necessary to fix its longevity clearly so that with it will cease the productive capital which is based entirely upon the net income derived from the crop. Afterwards the period of deterioration must be determined and a portion of the productive capital (which will cease with the tree) must be reduced annually. If the period of dererioration is from the 60th to the 80th year i. e., 20 years, the productive capital is reduced by 1 per 20 (i. e. 5 %) each year from the 60th year onwards. According to the number of years which elapse during this period of deterioration until the time of valuation, we shall therefore have $\frac{X}{20}$ to reduce. D or deterioration, being equal to 20 years, the number of years elapsed during this period being T we shall have to reduce T. The value of the tree will be:

$$V = CP \text{ or } \frac{100 \times R}{t} - \frac{T}{D}.$$

The author selects a cider apple tree whose longevity will extend over 80 years and the period of deterioration from the 60 th to the 80th year, and thus establishes the data: Duration of capital outlay: 10 years from the time of plantation. A = cost price 6 fr. + expenses 1.50 fr. = 7.50 fr. B = rent 0.20 fr. + expenses (1 fr.), = 1.20 fr. multiplied by the age of the tree.

Value of the cider apple tree at 10 *years.* $V = C\,O$ or $A + B$, i. e. V = 7.50 fr. + 1.20 fr. × 10) i. e., 19.50 fr.

Duration of productive capital 70 years.

Period of deterioration: 20 years.

The appended table examines the return of the yield.

From 10 to 15 years . . . . . 3 hl. of 54 kg. = 162 kg., average 32 kg. per annum = 3.20 fr. etc. etc.

As the average expenses vary from 2.20 to 3.50 fr., we obtain the net income from the yield, which when capitalised, gives the value at the different ages of the tree up to 60.

From 10 to 15 years . . .	3 hl of 54 kg.	=	162 kg;	average	32 kg	per annum	= fr.	3.20
» 15 to 20 » . . .	5 » of 54 »	=	270 »	»	54 »	» »	= »	5.40
» 20 to 25 » . . .	7 » of 54 »	=	378 »	»	74 »	» »	= »	7.50
» 25 to 30 » . . .	9 » of 54 »	=	486 »	»	97 »	» »	= »	9.70
» 30 to 40 » . . .	20 » of 54 »	=	1080 »	»	108 »	» »	= »	10.80
» 40 to 60 » . . .	50 » of 54 »	=	2700 »	»	135 »	» »	= »	13.50
» 60 to 80 » . . .	40 » of 54 »	=	2160 »	»	108 »	» »	= »	10.80
Total . . . **184**			**7236** kg. at 10 fr. per 100 kg = **723.60.** fr.					

From 10 to 15 years, $r - f$ =	3.20 — 2.20	= Net income =	1.00	fr.
» 15 to 20 years, $r - f$ =	5.40 — 2.20	= » » =	3.20	»
» 20 to 25 years, $r - f$ =	7.50 — 2.75	= » » =	4.75	»
» 25 to 30 years, $r - f$ =	9.70 — 3.30	= » » =	6.40	»
» 30 to 40 years, $r - f$ =	10.80 — 3.50	= » » =	7.30	»
» 40 to 60 years, $r - f$ =	13.50 — 3.50	= » » =	10.00	»

The value of the tree will be established as follows:

$$V = CP \text{ or } \frac{100 \times R}{i}$$

From 10 to 15 years . . . . . $\frac{100 \times 1}{5} = 20$

From 15 to 20 years . . . . . $\frac{100 \times 3.20}{5} = 64$

From 20 to 35 years . . . . . $\frac{100 \times 4.75}{5} = 95$

From 25 to 30 years . . . . . $\frac{100 \times 6.40}{5} = 128$

From 30 to 40 years . . . . . $\frac{100 \times 73}{5} = 146$

From 40 to 60 years . . . . . $\frac{100 \times 10}{5} = 200$

From 60 to 80 years $V = CP$. . . . . $\frac{(100 \times R)}{i} - \frac{T}{D}$

From 60 to 65 years $\frac{(100 \times 10)}{5} - \frac{5}{20} = 200 - 50$, i. e. 150 fr. at 65 years,

From 65 to 70 years $\frac{(100 \times 10)}{5} - \frac{10}{20} = 200 - 100$, i. e. 100 fr. at 70 years,

From 70 to 75 years $\frac{(100 \times 10)}{5} - \frac{15}{20} = 200 - 150$, i. e. 50 fr. at 75 years,

ending with zero, or rather, the value as fire wood at 80 years.

For trees whose wood is valuable, there must be added the further value "wood" to that of productive capital, especially for the walnut tree. It is simply a question of estimating the value of the wood at current prices and on the spot. In M. BRETON-BONNARD's method a smaller value is given to a tree (cider-apple tree) estimated at 26.50 fr., than the author who takes it at 64 fr.; at 40 years the former is valued at 51.50 fr., whereas the author,

Comparative Table of Valuation of a Cider-apple tree.

	Value in francs according to BRETON-BONNARD	Value in francs according to LÉCOLIER	Value in francs according to DELANNOY
Wheat planting	6.50	7.50	5.50
at 1 year	7.50	8.70	7
» 2 years	8.50	9.90	12
» 3 »	9.50	11.10	17
» 4 »	10.50	12.30	22
» 5 »	11.50	13.50	27
» 6 »	12.50	14.70	32
» 7 »	13.50	15.90	37
» 8 »	14.50	17.10	42
» 9 »	15.50	18.30	47
» 10 »	16.50	19.50	52
» 11 »	17.50	23.95	57
» 12 »	18.50	28.40	62
» 13 »	19.50	32.85	67
» 14 »	20.50	37.30	72
» 15 »	21.50	41.75	77
» 16 »	22.50	46.20	82
» 17 »	23.50	50.65	87
» 18 »	24.50	55.10	92
» 19 »	25.50	59.55	97
» 20 »	26.50	64	102
» 21 »	27.50	70.40	107
» 22 »	28.50	76.80	112
» 23 »	29.50	83.20	117
» 24 »	30.50	89.60	122
» 25 »	31.50	96.60	127
» 26 »	32.50	102.40	129
» 27 »	33.50	108.80	131
» 28 »	34.50	115.20	133
» 29 »	35.50	121.60	135
» 30 »	36.50	128	137
» 31 »	37.50	135.20	139
» 32 »	38.50	142.40	141
» 33 »	39.50	149.60	143
» 34 »	40.50	156.80	145
» 35 »	41.50	164	147
» 36 »	43.50	171.80	149
» 37 »	45.50	178.40	151
» 38 »	47.50	185.60	153
» 39 »	49.50	192.20	155
» 40 »	51.50	200	157
» 41 »	53.50	—	—
» 42 »	55.50	—	—
» 43 »	57.50	—	—
» 44 »	59.50	—	—
» 45 »	61.50	—	—
» 46 »	63.50	—	—
» 47 »	65.50	—	—
» 48 »	67.50	—	—
» 49 »	69.50	—	—

	Value in francs according to BRETON-BONNARD	Value in francs according to LÉCOLIER	Value in francs according to DELANNOY
at 50 years	71.50	—	—
» 51 »	73.50	—	—
» 52 »	75.50	—	—
» 53 »	77.50	—	—
» 54 »	79.50	—	—
» 55 »	81.50	—	—
» 56 »	83.50	—	—
» 57 »	85.50	—	—
» 58 »	87.50	—	—
» 59 »	89.50	—	—
» 60 »	91.50	—	—
» 61 »	94.50	—	—
» 62 »	98.50	190.20	157 − diminution value + value of the wood
» 63 »	87.50	180	—
» 64 »	83.50	160	—
» 65 »	81.50	150	—
» 66 »	79.50	140	—
» 67 »	77.50	130	—
» 68 »	75.50	120	—
» 69 »	73.50	110	—
» 70 »	71.50	100	—
» 71 »	69.50	90	—
» 72 »	67.50	80	—
» 73 »	65.50	70	—
» 74 »	63.50	60	—
» 75 »	61.50	50	—
» 76 »	59.50	40	—
» 77 »	57.50	30	—
» 78 »	55.50	20	—
» 79 »	53.50	10	—
» 80 »	51.50 as value of the wood	0 + value of the wood	—

taking into account its yield, estimates its value at 200 fr. The briefly summarised form of valuations of pruned trees given by the author does not allow him to discuss them at length, but his figures seem to fall short of the facts, especially for " palmettes " yielding choice fruit of greater value, sold separately, but necessitating the deduction of heavier expenses.

These figures are arbitrary, whereas those arrived at by the keep of the authors' general formula seem on the whole to be closer to the truth.

The method of M. DELANNOY (in *Vie à la Campagne*) does not seem any better to the author, because the plus-value of growth and labour added to the future plus-value makes the figures too high. Thus, according to the former, a cider tree will be worth 57 fr. at 10 years, whilst the author only calculates 19.50 fr.; at 20 years the former estimates its worth at 107 fr., but, according to the author it is only worth 64 fr. Finally between the age of 25 and 40 years the tree would be worth 157 fr., but

he does not clearly show the diminishing value from 40 to 80 years old., The author's method, which is based upon the yield or the income derived from the tree, without being absolute and purely mathematical is reasonable, for it comprises the chief elements constituting the value of the tree The same process that has been employed for the cider-apple tree could be used for any other kind of fruit tree.

In conclusion, the author gives a valuation table for the cider-apple tree, which has nothing absolute in its methods because it must vary according to the co-operating factors.

This table, given on pp. 904-405 reproduces the figures arrived at by the author's method and also by those of MM. BRETON-BONNARD and DELANNOY.

789 – **Profits from Pigeon Breeding in Italy.** — See No. 781 of this *Review*.

790 – **Cost and Yield of a Country Apiary.** — See No. 782 of this *Review*.

791 – **The Problem of the Cost of Milk.** — See No. 800 of this *Review*.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

792 – **Exhibition of Wines from Direct Bearers** (1) **at Perpignan, France.** — SOURSAC L., in *Bulletin du Syndicat des Pyrénées-Orientales* reproduced in *Le Progrès agricole et viticole*, Year 37, No. 21, pp. 491-492. Montpellier, May 23, 1920.

On May 4, 1920, at Perpignan a comparison of wine from direct bearers was made, and the following marks given, taking into account both colour and taste. The samples tested came from the Pyrenées-Orientales, Aude, Lades, Rhône, Allier, Loiret, and Deux-Sèvres districts. The white wine from certain hybrids, such as Gaillard-Girerd No. 157, seemed to be generally appreciated, but the others were on the whole judged according to soil for ungrafted or grafted hybrids, stock, climate, etc.

Marks given to Wines from Direct Bearers.

WHITE WINES.

Gaillard 157	17	Baco 22 A.	16
Gaillard 157	14 ½	Baco 22 A.	16
Gaillard 157	18	Baco 22 A.	16 ½
Gaillard 157	14 ½	Seibel 1880.	12
Gaillard 157	17	Seibel 1000.	15 ½
Gaillard 157	8	Seibel 4615.	7 ½
Gaillard 157	15	Seibel 4623.	15
Baco 22 A	12	Seibel 4638.	15
Seibel 4681.	15 ½	Bertille-Seyve 450	14 ½
Seibel 4964.	16 ½	Couderc 1	14 ½
Seibel 4991.	17	Couderc 299-35	11
Seibel 4991.	16 ½	Solomis Goldriesling.	12
Seibel 5001.	16		
Seibel 5182.	15	*Blend.*	
Seibel 5213.	14 ½		
Seibel 5279.	15	3 parts Gaillard 157.	17 ½
Seibel 1000-2859-880 (blend)	10 ½	3 » Couderc 272-60	
Thomur 2-16.	15	2 » Meslier del Gâtinais.	
Bertille-Seyve 450.	16	1 parts Couderc 177-3	

(1) See *R.*, April, 1920, No. 458. (*Ed.*)

ROSE COLOURED WINES.

Seibel 1000	12	Bertille-Seyve 893	9
Seibel 4430	8	Bertille-Seyve 1129	11
Seibel 4643	6	Baco 1	10
Seibel 5329	9	Gaillard 2	8
Bertille-Seyve 872	10	Gaillard 2595-893	9

RED WINES.

Baco 1	15	Gaillard 2	12
Baco 1	16	Gaillard 2	10
Baco 1	16	Gaillard 194	15
Estellat (30-12)	8	Gaillard 194	15
Estellat (30-12)	13	*Blend..*	
Oberlin 595	14		
Oberlin 595	8	2 part s S. 157	15
Oberlin 605	14	2 » Couderc 4401	
Seibel 1000	14	2 » Gaillard 2.	
Seibel 4643	11	2 » Gamay del Beaujolais	

793 – **The Action of Chloropicrin on Wine Yeast and Flowers of Wine.** – Bertrand G. and Mme Rosenblatt, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 22, pp. 1350-1352. Paris, May 31, 1920.

The authors have tested the action of chloropicrin (1) on 2 types of microscopic fungi, viz., yeast, when in a state of fermentation and completely submerged; and the flower of wine which lives on the surface of the nutritive medium.

The yeast experiments showed, that 1 mgm. of chloropicrin in one litre of sweetened must is sufficient to hinder fermentation, and that from 5 to 6 mgm. arrests the process completely.

The yeast, however, is not killed in 24 hours by the addition of sufficient chloropicrin to prevent fermentation. This small amount first paralyses the fungus, which gradually loses its reproductive power, but only succumbs after a much longer contact with the poison. In order to kill the yeast in 24 hours, at a temperature of 27° C, as much as from 30 to 40 mgm. of chloropicrin per litre must be added.

Flowers of wine are still more susceptible than yeast to the action of chloropicrin: 2 mgm. per litre entirely stop the growth of *Saccharomyces vini*. Even 1 mgm. per litre has proved sufficient to produce this result.

In the course of their experiments, the authors observed that, although flowers of wine grow so easily on the surface of common kinds of wine, only an excessively thin layer forms very slowly if the wine has been filtered through a Chamberland filter.

794 – **The Treatment of " Casse Bleue " in Wines.** – Piedallu, A., Malvezin, Ph. and Grandchamp, L., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 19, pp. 1129-1131. Paris, May 10, 1920.

One of the authors, in a previous article (2), described the action of hydrogen peroxide on wines affected by *casse bleue*. It is well-known that

(1) See also *R.*, July-Sept. 1919, Nos. 1049-1050; *R.*, Jan., 1920, Nos. 6 and 148; *R.* Feb., 1920, No. 274; *R.*, March, 1920, Nos. 374 and 375; *R.*, May, 1920, No. 595; *R.* June, 1920, No. 705. — (2) See *R.* Feb. 1920, No. 250; *R.* March, 1920, No. 359. (*Ed.*)

such wines contain ferrous salts. Though at first clear, they become cloudy through the action of the oxygen of the air, the ferrous salts, becoming ferric salts, are precipitated with the tannins and colouring matters; turbid wines deposit successive layers of these substances, but nevertheless remain thick. The operation of clarifying is useless, as the size, remains in solution.

Hydrogen peroxide precipitates a great deal of the iron (the wine becomes clear therefore, and there is no further formation of *casse bleue*), but it is illegal to add hydrogen peroxide to wine. Further, the very energetic action of the peroxide has a very bad effect upon the composition and organoleptic properties of wine. For this reason, the use of hydrogen peroxide was not recommended in the afore-mentioned article.

The authors have once more taken up the question and have investigated the action of gaseous oxygen obtained by the distillation of liquid air; it contained 99.9 % pure oxygen. When introduced by bubbling it directly into the wine, only unsatisfactory results were obtained. Large, bubbles were too rapidly evolved on the surface, and the oxidation was insufficient

On the other hand, most conclusive results were obtained by diffusing the oxygen by means of a Chamberland filter.

The oxygen, on leaving a " mano-détendeur ", enters the filter under a pressure of 4 kg. It leaves it, passing through the wall in small bubbles which form a sort of emulsion with the wine. The latter is now saturated with oxygen, and the ferrous salts become oxidised to ferric salts. In the presence of tannins, the ferric salts form insoluble tannates, and are precipitated, the albumens and gelatins becoming coagulated at the same time.

It has been observed that gelatin and albumens remain in solution when the iron is in a ferrous condition, hence the expression that the wine " ne prend pas la colle " i. e., will not clear.

The authors have found that a wine that will not clear, coagulates, after oxidation, 20 gm. of white refined gelatin per hl. becomes clear and remains so in spite of prolonged exposure to the air, and to changes of temperature.

In a white wine containing 160 mgm. of metallic iron per litre, the authors observed only a slight bluish reaction when tannin was added, and consequently a very slight precipitate. The same wine, under identical conditions, when oxidised by means of a Chamberland filter, gave a reaction of increasing intensity finally becoming bluish-black like ink. The reaction continued with the same intensity for 24 hours, and after 36 hours, the authors were able to see the beginning of defecation, clear patches appearing near the surface of the liquid. On the fourth day this wine had been clarified with refined white gelatin which was precipitated as a thick coagulum, leaving in suspension in the liquid small grey flakes, which on filtering, remained on the filter. The wine became clear after one filtering.

Analysis, after filtration, revealed the loss of 120 mgm. of iron per litre, viz. 75 % of the original amount. It would have been easy to have eliminated more of the iron.

Many red wines have been treated in the same way with identical results. Red wines attacked by " casse ", on being oxidised under the same conditions, but without the addition of tannin, lost iron in similar proportions, and finally became, after filtration, brilliant wines of a fine ruby colour, and perfectly stable.

To sum up : oxygen, when very finely divided by passing under pressure through the pores of a Chamberland filter, is capable of rapidly transforming into ferric salts the ferrous salts in a wine affected with *casse bleue*. This change removes the iron which produced the turbidity, and restores the wine to its normal clearness. Wines so treated become perfectly stable, and are not liable to relapse into their former condition.

795 – **The Use of the Bulbs of *Muscari comosum* and *Hyacinthus ciliatus* Used as Food and in the Manufacture of Alcohol in Italy.** — PANTANELLI, E., in *Le Stazioni Sperimentali agrarie italiane*, Vol. LIII, Nos. 1-3, pp. 101-112, bibliography of 6 works 1 plate. Modena, 1920.

In the Province of Foggia (Apulia), the bulbs of two wild plants which are much alike in appearance (*Muscari comosum* and *Hyacinthus ciliatus* are used as articles of food. The former plant, known in Apulia by the name of " lampascione ", has the larger bulb, is covered with red scales, and is more savoury than the bulb of *Hyacinthus ciliatus*, owing to its slightly bitter taste ; further, it is richer than the latter in laxative and diuretic substances, etc. It is exported to some extent to North America, where it is eaten by Apulian emigrants. The bulb of *H. ciliatus*, which is called " cipollaccio ", or " giacinto pugliese ", has white scales, is sweeter, and is less in request.

The author, having found that the bulbs of both these plants contained much sugar and were rich in saccharifiable carbohydrates (23.01 and 20.21 % respectively at the close of the vegetative period), tried to utilise them in the manufacture of alcohol.

Bulbs collected at the end of January, when the plants were already in leaf, and also at the beginning of June, immediately after flowering, were found on analysis, to have the composition given in the following table.

At the end of the growing period, the bulbs of the pink " lampascione " are rich in sugar, in soluble mucilage and in starch, whereas they contain little insoluble mucilage, less cellulose, and almost no hemicellulose.

The bulbs of the white " cipollacco " have a smaller sugar content, and more starch, hemicellulose and cellulose, the last-named substances rendering them less fit for human consumption. Although the bulbs of the " lampascione " contain more sugar at the beginning of summer, they are eaten by preference in winter.

By hydrolysing the sliced bulbs with sulphuric acid, 10.5 % by weight and 13 % by volume (the percentage refers to fresh bulbs) of anhydrous

Composition of the bulbs of Muscari comosum and Hyacinthus cilatus.

	January		June	
	Muscari comosum	*Hyacinthus ciliatus*	*Muscari comosum*	*Hyacinthus ciliatus*
Water	70.09 %	67.72 %	70.85 %	72.14 %
Crude protein (N × 6,25)	0.740	1.129	0.814	1.313
Reducing sugar	0.366	0.206	0.117	0.311
Non-reducing sugar	8.952	8.600	9.000	4.751
Soluble mucilage	11.240	4.630	6.743	2.384
Insoluble mucilage	2.004	2.085	1.030	2.008
Starch	0.372	5.100	6.041	7.106
Hemicellulose	0.212	3.014	0.080	3.650
Cellulose	3.412	4.300	3.038	4.211

alcohol is obtained from *Muscari comosum* and 8.4 and 10.5 % respectively from *Hyacinthus ciliatus*. The process is carried out as follows. The sliced bulbs are boiled for 90 minutes with an equal weight of 4 % sulphuric acid solution, then neutralised with calcium carbonate, pressed, and 1 % of ammonium phosphate added. Normal tartaric acid is then added until the precipitate of calcium phosphates is dissolved, and a little brewers' yeast is introduced, and the mixture is fermented at 20° C for 4 days. The alcohol yield obtained is sufficient to employ a distillery satisfactorily.

The author is of opinion that the bulbs of *Muscari comosum*, which are preferred as an article of diet to those of *Hyacinthus ciliatus*, should be cultivated, for the manufacture of alcohol, since they contain as much as 23 % of saccharifiable carbohydrates which can be transformed into alcohol by fermentation. On the other hand, the bulbs of *H. ciliatus* would not pay for cultivation, but they are less common than those of *M. comosum*. The best season for collecting bulbs for the distillery is from June to December, because as soon as the growth begins they lose some of their sugar content. The bulbs should be used fresh, since on being dried, they lose part of their sugar through respiration, and the resin is condensed into carbohydrates which are difficult to convert into sugar.

796 – **The Use of Milk Powder in Bread-Making.** — LINDET, L., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 18, pp. 465-417. Paris, May 12, 192

M. Lindet exhibited milk bread made with desiccated skim-milk.

This bread has a good flavour, and rises very satisfactorily even when the quality of the flour used, leaves much to be desired. The skim-milk powder absorbs as much water as the flour, and this may be replaced weight by weight, by the milk powder. If 10, 15 or 20 % of the latter is added, and the consumer eats the same amount of bread, a saving of 10, 15, or 20 % of the flour is effected.

In flours, the proportion of the carbohydrates (starch, sugars,. etc.) to the nitrogenous substances is as 100 is to 17 or 18; in skim-milk the proportion of lactose to casein is as 100 is to 70. In wheat bread with

the present flours extracted at 80 %, there is from 8 to 9 % of nitrogenous substances, while in a bread containing 15 % of milk powder, there will be from 15 to 16 %.

At the present time, milk powder costs 4,20 fr. per kg. but as milk bread is a luxury article, it finds customers, even at a high price.

It might be objected that skim milk itself could be used, instead of the milk powder, which would avoid the need for evaporation. This might be done, if the dairy were near the bakery, but skim-milk soon turns acid. It is true that it might be pasteurised or sterilised, but the coal used in these operations, and the transport of the water contained in skim-milk, would cost more than the coal needed for desiccating the milk.

In short, M. LINDET believes that the manufacture of milk bread might be encouraged without detriment to the general food supply, and that its use would economise the flour supply. However, he draws attention to the fact that such bread is article of luxury, and superfluous from the point of view of strict necessity.

797 – **The Italian Grape-pip Oil Industry.** — FACHINI, S. in the *Giornale di Chimica industriale ed applicata*, Year II, No. 5, pp. 246-250, 1 fig. Milan, May, 1920.

The production of grape-pip oil is an Italian industry dating back a great many years, for as early as 1770, this oil was already extracted at Bergamo, and, during the last 20 years, the industry has much developed. The distilleries usually supply the oil mills with the grape pips. These. are divided into 2 commercial varieties, undistilled pips (at represent worth about 60 lire per quintal (as against 6 lire before the war); and cooked, or distilled pips that have been separated from the marc after distillation. Such pips now fetch 40 lire per quintal (pre-war price 3 or 4 lire). The oil content of the former varies from 12 to 20 %; that of the latter smaller, and sometimes sinks as low as 8 %.

Some writers believe that there is a direct connection between the oil yield and the alcohol yield, but recent analytical results haw shown that the grape-pips of some regions of S. Italy have a much lower oil content than those of certain parts of N. Italy, where the grapes produce a wine containing but little alcohol.

The oil yield, however, depends in the first place upon the vine, and. in the second, in the case of white grapes, upon the age of the pips, etc. The pips most valued are those from Venetia, which have the highest oil content (20 %).

The most important factories using grape-pips are, according to the author, in Lombardy (Milan, Monza, Treviglio, Cologna, Bergamo and Lecce), and Piedmont.

Pressure is the usual method employed for extracting the oil. The pips after having been ground very finely in a mill or by rollers, are heated to from 50-60° C in desiccators by means of direct heat or steam, and after moistening, an indispensable operation for insuring a good oil yield, pressed in the ordinary presses used for oilseeds. Some makers prefer stave presses, or the types known respectively as " a vaso filtro ", or " a forata. "

For the pips, the best machine is the " tordoir ", with this, the work is automatic and simple.

The ground pips are heated by a double endless screw protected by a double wall and are carried slowly foward by this to the end of the upper cylinder (heater). From the cylinder, the hot oil meal falls to the bottom, where by means of a cone, and a truncated cone, it is crushed under very high pressure. The oil is thus expressed, and the residues are evacuated at the posterior part of the machine. According to the makers of this machine (FRANS SMULDER of Utrecht), all kinds of oil seeds and nuts can be crushed by it. It can grind from 150 to 200 kg. of seed per hour, according to the quality. It weighs 5 000 kg., needs no base and has the following measurements :— Length, 4.85 m. ; width 1.63 m. ; height 2.90 m. As this crusher does not require continual supervision, it saves labour to a great extent, and also has the advantage of rendering cloths unnecessary.

The first industrial use made of grape-pip oil was for burning, either alone, or specially mixed with rape oil. It is also used in soap-making, in paints and in the manufacture of substitutes, but for the last 5 years especially, the oil, when well purified, has chiefly been employed (either alone, or mixed with olive oil) as an article of food. Indeed, it can be said that all the grape-pip oil not made in Italy is used for this purpose.

If the annual average grape production of Italy is estimated at 60 million quintals, the pips produced per quintal of grapes at 3.7 kg., and the oil yield at 12%, the possible annual production of pip-oil in Italy would be 266 000 quintals. The manufacturing expenses may be reckoned at 15 lire per quintal. Commercial grape-pip oil is now sold at from 500 to 600 lire per quintal, and the edible oil at from 700 to 800 lire per quintal. From 100 kg. of grape-pips 88 kg. of cake may be made, which sells at 20 lire the quintal.

798 - **Contributions to the Microscopic Detection of Plant Substances that can be Used in the Adulteration of Certain Articles of Food, or as Their Substitutes.** — I. GRIEBEL, C., in *Zeitschrift für Untersuchung der Nahrungs und Genussmittel*, Vol. XXXVII, Nos. 5-6, pp. 129-141, figs. 15 Münster, September, 1919. — II. GRIEBEL, C. and SCHÄFER, A., *Ibid.*, pp. 141-145, figs.3.

I. — The author describes the characters of many substances that can be used to adulterate flour, jams and spice. In the case of flour, husks, straw, the germs of embryos can be used ; in that of jams and similar articles, recourse can be had to the fleshy aril enclosing the seeds of the yew (*Taxus baccata*), the fruits of the crowberry (*Empetum nigrum*), and Irish moss (*Chondrus crispus*). The seeds of *Piper officinarum* are used as a substitute for black pepper, while the edible fungus *Boletus edulis*, when dried and ground, serves to adulterate spices in general. As new substances that are mixed with coffee, the author mentions the dregs of must, and the berries of the holly (*Ilex Aquifolium*) (1).

(1) In a preceding paper (*Zeitschrift für Untersuchung der Nahrungs und Genussmittel* Vol. XXXV, No. 6, pp. 233-235, 1918), the author described the microscopic characters of the seeds of *Ornithopus sativus*, which are used in Germany as a substitute for coffee. (*Ed.*)

In samples taken from dried leaves of commercial marjoram, dried ground leaves of *Thymus Serpyllum* have been found. The authors describe and illustrate by means of figures the microscopic differences serving to distinguish garden thyme (*Thymus vulgaris*) from wild thyme (*T. Serpyllum*) and from marjoram (*Origanum Majorana*).

799 – **The Utilisation of Sugar Cane Bagasse in Paper-Making.** — MAHEN, J. and MATROD, L., in the *Bulletin de l'Agence Générale des Colonies* (formerly *Bulletin de l'Office Colonial*), Year XIII, No. 146, pp. 139-154, figs. 19. Paris-Melun, February, 1920.

The idea of using bagasse in the manufacture of paper is so tempting that it is not surprising that attempts have been made to realise it. As long ago as 1835 a process was brought forward, but all experiments in this direction proved fruitless, or at least, unsatisfactory.

Recently, however, owing to the shortage of paper, the authors thought it opportune to resume the study of the question, and their experiments upon sugar-cane refuse from Guadeloupe have proved the paper-maching qualities of this raw material.

Chemical examination of sugar-cane refuse has shown that it contains 49 % of cellulose, as against 58 % of lignin, accompanied by small quantities of mineral and waxy substances.

In the technical experiments the theoretical yield fell to the 30 % of so-called paper cellulose, which represents the small loss of about 9 %. This is probably due to the fact that the fibre has already been exhausted by water under pressure, so that the nonfelting substances are largely removed during the extraction of the sugar. The yield obtained is sufficient to justify the use of sugar-cane bagasse in paper-making.

In the laboratory experiments a rough paper was made which had a pinkish yellow colour due to the presence of 7.64 % of lignin. It was rather granular to the touch, had a certain amount of consistency, was slightly resonant, offered a satisfactory resistance to pulling and crumpling, and was not easily torn. The coloration can be prevented by removing the 7.46% of lignin still present, which was reveled by the chemical analysis of the pulp.

Comparison between the paper-making cellulose yield of bagasse and that of other raw materials.

Bagasse		30
Lucerne		40 to 48
Bamboo		45
Straw		35 to 50
Dà (*Hibiscus cannabinus*) bast		50 to 60
Common hemp	straw	25 to 27
	spinning refuse	65 to 70
	fibre	85 to 87
Cotton rags		63 to 67
Flax fibre		70 to 80

Micrographic investigation shows why the cellulose pulp obtained is defective. Those fibres that had not been swollen or deformed by pre-

vious treatment, were such, owing to their fineness, suppleness, tenacity and felting capacity (0.007), that this pulp would be classed among those of superior quality, were it not accompanied by a large number of other elements greatly inferior morphologically, and therefore possessing but little binding power. The presence of these inferior fibres explains why it was found necessary in the commercial experiments made some years ago at Trinidad to incorporate a certain proportion of foreign fibres in the pulp.

On the other hand, the chemical analysis of the pulp proved that it would be easy to obtain, by means of a moderate amount of treatment, a cellulose containing only 1 to 2 % of impurities, and that the oxycellulose present in fairly large quantities (4.30 %) in the raw fibre, disappears to a great extent in the course of these processes, so that there was no fear of the paper keeping badly, owing to subsequent alterations.

It should be mentioned that all the technical experiments carried out failed to reveal the presence of the gummy substances that are so detrimental to the paper, or any difficulty in bleaching, such as had been encountered by some experimenters.

The preparation of the cellulose, indeed, appeared to be quite simple. It is probable that the very special structure of the raw material in question, and the previous treatment it had received in the diffusers, facilitated the action of the caustic alkalis, and promoted delignification. Bleaching took place normally. The pulp further dried quickly on the sieves of the mould, which is another proof of the absence of gummy matters.

In short, Guadeloupe bagasse gives 30 % of cellulose suitable for paper-making, which is excellent for a by-product. The nature of this cellulose leads us to hope that it will find a ready market among paper manufacturers. Should this be the case, it would be necessary to replace the bagasse now used as fuel by the importation into the Colony of an equivalent amount of coal and perhaps also of fertilisers, for the ash of bagasse contains 2.5 % of mineral matter (silica, lime, iron, and traces of manganese), which must be replaced in the soil, in order to restore some of the substances of which it is annually deprived by the cultivation of sugar cane.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

800 – **Milk and Milk Products.** — *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 18, pp. 459-462. Paris, May 12, 1920.

Dr. E. LAUR, Director of the Swiss Peasants' Union, and M. J. RAECH of the Central Prices Bureau of that Union forwarded to the Académie d'Agriculture de France the following letter addressed to the agricultural organisations of the various countries :

" The purchasers of milk and milk products are at the present time bringing unusual pressure upon the international market. Next summer it is proposed to pay for milk, prices that no longer at all correspond to the cost of production. Although salaries and wages have everywhere risen, and are still rising, an attempt is being made to reduce the profit

of the milk producer to such an extent, that the most hard-working and useful worker of the state will be the worst paid.

" The Swiss agriculturists are firmly resolved to oppose these efforts by every means, and they also request the Authorities to second their endeavours. The peasant was obliged, during the war, for the sake of the customers, to renounce taking full advantage of the condition of the market, and has thus every right to demand to be protected from the results of too sudden a return to ordinary prices.

" This end can, however, only be attained if the agriculturists of all milk producing States energetically oppose the efforts made by the purchasers to bring presure to bear upon the price of milk. It is inevitable that some fall in prices will occur in cases where they greatly inflated during the war. But, from information obtained from certain countries, such as the Netherlands and, in part, from France, it would appear that the producers in those regions are not inclined to concede too much to the purchasers.

" Swiss agriculturists demand for next summer a price of 35 centimes (Swiss) for each kg. of milk bought at the farm. This is 2 to 3 centimes, or 8 % less than the price in the winter of 1919-1920.

" Agricultural associations must see that milk sold for consumption fetches a price corresponding to the cost of producing it. By so doing, it will be easier to ensure fair prices being paid for milk products, as well as for the milk used in their manufacture. In Switzerland, the agriculturists together with the trade, have formed a large society with the object of purchasing all the cheese production of the country at a price corresponding to that of milk used for ordinary consumption. This will ensure uniform prices for all the producers.

" We would request all Agricultural Associations to explain the situation to agriculturists, and to induce them to resist all pressure appied to the international market of milk and milk products. A plan likely to yield good results would be to reduce milk production as much as possible, and increase the cultivation of cereals.

As long as the Russian political situation does not improve, and while that country does not take part in supplying Europe, the demand for cereals will doubtless remain very large. In spite of the precarious condition of their exchange, those States that are threatened with famine will buy cereals before everything else, and their demands will keep up the price of these products. It is, further, of the utmost importance, that the Governments should help one another to relieve the present pressure exerted upon the market of milk and its products by granting credit to the famine-threatened States, with a view to enabling them to purchase butter and cheese.

" The granting of this credit would soon obtain the sale required for these products. It is also necessary to promote the consumption of milk and milk products as much as possible. "

The Permanent Secretary of the Académie adds that the Agricultural

Associations of France are unanimous in demanding the abolition of the controlled price of milk. The French Minister of Agriculture has promised, for his part, that no legal proceedings will be taken against milk producers, until the opinion of the Departmental Agricultural Office has been obtained as to the technical aspect of the case.

801 – **Plastic Materials with a Casein Basis: Galalith and Cornalith.** — DAUTREBANDE, J., in *Annales de Gembloux*, Year 26, Series 5, pp. 214-216. Brussels, May, 1920.

Galalith and cornalith, two substances made from casein that has been treated with formalin, are produced now in various countries, especially in France, where there are already several factories.

The process may be said to consist of three stages: (1) Preparation of the casein; (2) moulding the casein by means of pressure; (3) treatment with formaldehyde. If opaque articles are to be made, dried commercial casein powder is used, without any further treatment. Should transparent goods be required, the casein must be demineralised by being dissolved in soda and precipitated by an acid, for in this case, all the mineral salts, especially the phosphates, must be removed. The casein, whether it has undergone this preparation or not, is mixed with water into a consistent paste; this is put into suitable moulds, and subjected to great pressure at a high temperature in hydraulic presses, whose plates are heated by steam. In this manner, plastic masses are obtained, which have only to be put into a bath of formaldehyde in order to render the casein insoluble. The strength of the formaldehyde solution, and the length of the immersion vary according to the nature, and thickness of the articles made.

The masses of casein hardened in this way by formaldehyde, can be sawn, cut, perforated, and made into any object required. The original colour of the product is pinkish-white, but all kinds of tints can be obtained by the use of colouring matters. All articles that are made of celluloid can now be manufactured from casein coloured black, the latter is used as a substitute for ebonite; when white, it makes a good imitation of ivory, and has the advantage over celluloid of being free from all odour of camphor. Its great superiority over celluloid, however, consists in its not being inflammable on exposure to heat. A very high temperature, however, dries it up and blackens it.

Although celluloid still holds an important place in the industry of plastic materials, objects made of casein are becoming increasingly popular, and already show signs of supplanting those of celluloid. If a factory for the working of casein were attached to dairies, it would greatly assist the dairy industry.

In order to diminish the cost of opaque articles of casein treated with formaldehyde, various nitrogenous matters, such as the refuse of horns, hair, and horse-hair, are sometimes mixed with the raw materials. Attempts have also been made to use vegetable casein extracted from soya seed, instead of animal casein (that made from milk), which is more expensive.

802 – **New Contributions to the Study of Lactic Silages** (1). — GORINI, C., in *R. Istituto Lombardo di Science e Lettere*, Vol. LIII, Part. XI. Milan, May 20, 1920.

Investigations made in the United States and in England have confirmed the conclusions arrived at by the author as the result of a long series of experiments upon silaged fodder. He found that it was impossible to dispense with the action of bacteria, hence it was necessary that lactic ferments should preponderate, in order to preserve the silage against harmful and destructive fermentation.

In the present article, the author quotes the work of Swiss investigators, who have reached the same conclusion (*Schweizerische Milchzeitung*, 1917, Nos. 51 and 94 ; BURRI, R., *Ibidem*, 1918, Nos. 57, 58, and 61 ; 1919, Nos. 72 and 75 ; BURRI, R., STAUB, W. and HOHL, J., *Ibid.*, Nos. 78 to 83).

Of late years, there has been a strong movement in Switzerland, in favour of the silaging fodders. The "Herba" Co. has been established at Rapperswil for the object of exploiting a special patent mechanical pressure silo with cover, devised by MM. J. A. SONDEREGGER and A. MESMER (2). This system would ensure the success of sweet or as the author terms them) lactic silages by preventing the troubles arising from the use of acid silages, called butyric by the writer from the predominant bacterial flora.

The use of silage has, however, evoked the protests of cheese manufacturers, who complain, that it is impossible to make normal cheese from the milk of cows fed on these fodders (The same thing occurred in Italy, and it was these objections that have determined and guided the author's researches since 1903). The question was investigated by the Federal Dairy and Bacteriological Establishment at Liebefeld, near Berne, and the results otained coincided with those previously published by the author, namely : (1) Failure in making good cheese from the milk of cows fed on silaged fodders is not due to the ordinary gas-producing members of the *B. Coli aerogenes* group (the agents causing swelling in cheeses), but to the presence of butyric ferments ; in fact, these bacteria were found both in the silage and in the milk of the cows to which it was fed ; (2) these harmful micro-organisms (this according to the author is the most important result of his investigations) are not only to be found in spoilt or badly-made (that is to say abnormal) silage, or in acid (butyric) silage, but also in the best silage which appears perfectly normal and sweet. As the author has shown, the presence of butyric ferments may be prevented by half-drying the fodder, and by limiting the fermentation temperature. If this is below 50° C, lactic fermentation predominates, and if the temperature is raised to 70° C, as was formerly the custom, the silage is almost sterile; the most dangerous temperature is between 50° and 60° C, because it destroys the lactic ferments, but has no effect upon the butyric ones.

In his recent experiments, the author found butyric ferments even in masses of half-dried silage, when the fermentation temperature had

(1) See *R.*, January, 1916, No. 109 ; *R.*, February, 1916, No. 232 ; *R.*, February, 1918, No. 221 ; *R.*, February, 1919, No. 257 ; *R.* July-Sept., 1919, No. 1010. (*Ed.*)

(2) For a similar system devised by Prof. SAMAZINI, see *R.*, January, 1919, No. 105. (*Ed.*)

been between 30° and 40° C, and the silo provided with an impermeable cover. In this case, too much reliance had been placed in the perfect working of the cover, and in the antibacterial action of the carbonic acid produced by cellular respiration, and therefore a pressure of from 2-3 quintals per sq. metre had been considered sufficient, whereas it appears from the authors investigations, and from practical experience, that a pressure of 10 quintals per sq. m.is necessary. But even if every technical precaution is taken to promote natural lactic fermentation, it is not always possible to ensure a sufficient degree of it, or its permanence. Butyric ferments persist surreptitiously, and may become predominant if, for example, the silage is left for some time on carts, or piled up near the cow-shed. In order to avoid this hidden danger in cheese-making, it is advisable to use selected ferments, rather then antiseptics, or ordinary salt (which in given quantities hinders the growth of butyric ferments, but not that of the lactic ones). This has been advised and urged by the author since 1906, and is at present practised in France, Germany, the United States, and even in Switzerland, where the " Herba " Co. has patented a special method of inoculating with selected ferments.

With regard to the choice of the latter, it is necessary, in the first place, to use those lactic ferments, which do not attack lactose so readily as the sugars most commonly present in fodders (saccharose, pentose, etc.); in the second place, their proteolyptic properties must also be taken into consideration, in order at the same time to obtain a useful transformation of the albuminoids.

803 - **Handling and Transport of New Potatoes.** — GRIMES, A. M., in *U. S. Department of Agriculture, Farmers' Bulletin* 1050, 18 pp., figs. 18, Washington, 1919.

A study of the causes of the losses sustained during transport and sale by early potatoes sent from the Southern States of the North-American Union to the Northern States, together with a description of the methods of handling, packing, and loading, which would reduce these losses to a minimum.

Much loss is due to injuries caused by careless lifting, by the subsequent exposure of the potatoes to the sun, as well as by faulty methods of loading the trucks, owing to which some of the barrels slip, and get broken during transit. The best barrel to use is one with a double bottom. It is of the greatest importance that the trucks should be very well aerated during the journey, and that the barrels should be arranged in such a way that they cannot shift from their places.

804 - **Great Success of Meat-Canning Factories in Madagascar** (1). — *Bulletin de l'Agence Générale des Colonies*, Colonial Ministry, Year XXIII, No. 146, p. 178, February, 1920. Paris-Melun, 1920.

Since January 1920, the meat-canning factories in Madagascar have paid a tax of 2 fr. and 3 fr. respectively on every pig and ox

(1) See *R.*, February, 1920, No. 258. (*Ed.*)

slaughtered. It has been calculated that this tax will being in more than one million fr. annually, which shows the rapid extension of these factories in the Colony.

Their success is to some extent due to the war, but other causes will soon promote their development. France, at the present time, imports American meat to the value of many million of francs. As soon as it is recognised that the Madagascar products are as good, or better, than those imported from South America, they will take the place of the latter on the French market.

DISEASES OF PLANTS

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

805 – **Topping Wheat to Prevent Lodging.** — See No. 741 of this *Review*.

806 – **Observations on the Nature and Control of Apple Scald.** — BROOKS, C., COOLEY, J. S. and FISHER, D. F., in the *Journal of Agricultural Research*, Vol. XVIII, No. 4, pp. 211, 240, figs. 2. Washington, D. C., 1919.

Scald is typically a skin disease of the apple. In the early and more typical stages of the trouble, only the five or six surface layers of cells that form the colour-bearing tissue are affected. With long continued unfavourable conditions, the apple tissue may become dead, brown and rotted to a depth of $^1/_8$ to $^1/_4$ inch, and occasionally the disease spreads practically to the core.

The experiments undertaken have demonstrated that the occurrence of apple scald is determined by orchard, packing house, transportation, and storage conditions.

As has been shown by other investigators, mature fruit has in general scalded less than immature ; but it has also been found that the fruit surfaces just changing from green to yellow have scalded worse than those that were coloured leaf green, and worse than those that had more completely changed to yellow. Well-coloured red-fruit surfaces have been found practically immune to scald.

Apples from trees receiving heavy irrigation scalded worse than those from trees receiving lighter irrigation. This was found not to be due to the greater number of large apples in the former case, but to some forcing effect that increased the susceptibility to scald in both large and small apples.

Delayed storage increased or decreased apple scald according to the amount of aeration the apples received previous to packing.

Apples in ventilated barrels developed less than $^1/_3$ as much scald as those in commercial barrels, when both were held in a storage that received occasional ventilation, but where the storage room received little or no ventilation, the ventilated barrels caused but little decrease in scald.

The amount of scald developed in cold-storage plants varied greatly with the location of the room. Apples near the passage or near a door scalded less than those in the bottom of the stack. Boxed apples exposed

to a continuous air current of 0.88 mile per hour, in a commercial storage plant remained practically free from scald, while similar apples that did not receive constant fanning became badly scalded. Agitating the storage air had been found more important than its renewal, in the prevention of apple-scald.

The ordinary commercial apple wrappers caused but little decrease in scald, and paraffin wrappers were only slightly better ; but wrappers impregnated with various fats and oils either entirely prevented the disease or reduced it to a negligible quantity. In barrel experiments in which only part of the fruit was wrapped, scald was greatly reduced on the apples close to the wrapped ones, as well as on the latter themselves.

Typical scald has been artificially produced within a few days by exposing apples to the vapours of ethyl acetate, amyl acetate, or methyl butyrate.

The manner in which scald can be produced artificially, and the different methods of control indicate that the disease is due to the accumulation of esters or similar products of the apple, in the tissues of the fruit and in the surrounding air. The vapours of these substances can be dispersed by air currents or absorbed by fats and oils.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

RESISTANT PLANTS

807 – **Wheat Varieties Resistant to Rust in British East Africa.** — See No. 733 of this *Review*.

808 – **The "Duranthon" Vine. A Direct Bearer Resistant to Fungoid Diseases and to Phylloxera, in Piedmont, Italy.** — See No. 768 of this *Review*.

MEANS OF PREVENTION AND CONTROL

809 – **Formaldehyde Treatment of Seed Maize to Prevent the Growth of Fungi.** — See No. 729 of this *Review*.

DISEASES OF VARIOUS CROPS

810 – ***Helminthosporium*** **sp., the Cause "Foot Rot" of Wheat, in Illinois U. S. A.** — STEVENS, F. L., in *Science*, New Series, Vol. LI, No. 1325, pp. 517-518. Lancaster, Pa., May 21, 1920.

In the spring of 1919, attention was called to the occurrence of a foot rot of wheat in Madison Co., Illinois. From the first it appeared probable that a certain fungus was the cause of the disease, and as early as June, 1919, records show that this fungus was universally present, and that inoculations with pure cultures gave positive results.

These preliminary investigations were clearly and conclusively confirmed by subsequent research work.

The fungus in question is a typical member of the genus *Helminthosporium*.

This disease, while of the general type of foot rot known heretofore in Europe, Australia and elsewhere, is caused by on organism not hitherto designated as a cause of foot rot in any of the publications in the countries mentioned. The foot rot found in Illinois should therefore be recog-

nised as a disease quite distinct from all others of a similar type described previously. The experiments clearly proved that it is soil-borne, and it is probable also that it is also seed borne. How serious the disease may prove to be, and how far it is dependent upon local conditions of climate and soil, can only be decided after one or more years of additional observation.

811 – ***Bacterium glycineum* n. sp. Injurious to the Soya Bean *(Glycine hispida)* in U. S. A.** — COERPER, F. M. in the *Journal of Agricultural Research*, Vol. XVIII, No 4, pp. 179-193, figs. 1, pl. 8. Washington, D. C., 1919.

Description of bacterial blight of the soya bean (*Glycine hispida* Maxim), first observed some years ago, and since subject to investigation on the experimental plots at the University of Wisconsin, Madison. Subsequent observation proved the blight to be very prevalent throughout the soya bean fields of Wisconsin. A disease showing symptoms of the same type has been reported from various other localities in the United States.

It is characterised on the leaves, where it is most conspicuous, by small angular spots, either isolated, or confluent. The lesions are light-coloured and translucent in early stages and very dark-coloured in late stages. In the latter case also, the diseased tissue may become dry and detached from the rest of the leaf. Bacterial exudate occurs on the leaf spots in the form of small drops, but it is not very evident except under favourable moisture conditions. It is pale in colour and dries as granules or scales.

Petiole, stem and pod lesions accompany the disease on the leaves. Exudations have been observed on petioles and pods.

The blight is caused by a bacterium described by the author as a new species under the name of *Bacterium glycineum*. The organism is able to enter the tissues of the host plant without wounds. The organism has been isolated repeatedly, and pure cultures obtained.

Simply spraying water suspensions of the organism upon soya bean plants is sufficient to produce infection. It is advisable, however, to rub the tissue gently between the fingers to insure contact between inoculum and plant surface.

The best growth of the organism occurs between 24° and 26° C, the maximum at about 35°. The absolute minimum has not been determined, but growth is slow at 2°.

The organism is sensitive to desiccation, and there seems to be gradual loss in pathogenicity when it is grown in artificial culture. Razor sections of lesions in fresh leaves show the bacterial invasion to be in the parenchymatous tissue. Infection evidently takes place through the stomata.

Until further work on wintering and dissemination has been done, it is impossible to recommend any specific control measures aiming to check the development and spread of the disease in the field. At present the development of disease resistant varieties seems to offer the greatest promise.

812 – ***Spongospora subterranea* Affecting Potatoes in Switzerland.** — *Schweizerische Landswirtschaft liche Zeit schrift*, Year XLVIII, Part I, pp. 5-7, figs. 1 Zurich 1920.

The Agricultural Experiment Station at Ärlikon (Zurich) states that during 1919 the potato-disease known as "scab" (*Spongospora subterranea*), appeared in various parts of Switzerland.

This disease — for which the popular German name of Kartoffelräude has been suggested — seems to attack certain varieties of potatoes more than others. Thus, for instance, in the Cantons of Berne, Zurich, and Thurgau, the tubers of Bauernglück were affected, sometimes seriously, while other kinds were immune. The symptoms of the disease are given, and also the methods suggested for its control.

813 – **Two Destructive Rusts Ready to Invade the United States.** — ARTHUR, J.C., in *Science*, New series, vol. LI, No. 1314, pp. 246- 247 Lancaster, Pa., March 5, 1920.

The author calls attention to two rust fungi that seem to possess the possibilities of great harm, but which have not yet invaded the United States.

The peanut crop is a large and growing industry in the Southern States. There is a rust of peanuts widely distributed in South America, and becoming common in the West Indies. It is usually designated by the name of *Uredo Arachidis*, although a sample from Paraguay would indicate that it, should be called *Puccinia Arachidis*. It is has been known to mycologists since 1884, but has only very recently attracted the attention of cultivators. Specimens, of this rust were received by the author in September, 1916, from W. ROBSON of Montserrat (West Indies); every leaf was covered with the abundant brownish-yellow powder of the fungus. According to Mr. ROBSON, in some seasons, it is a serious menace to the peanut crop on that island. Attempts to control it with Bordeaux mixture did not prove satisfactory.

The life cycle of the rust has not been worked out, but with cultivated plants, only the uredospore is produced, as observed in 1913 in Porto Rico, and in 1915 in Cuba.

The second rust to which the author calls attention is *Puccinia Pittieriana*, which attacks potatoes and tomatoes. It was collected by H. PITTIER on the wild potato in 1903 and 1904, and again in 1916 by E. W. D. HOLWAY on the slopes of the volcano Irazù in Costa Rica. It has been mentioned also under the name of *Uredo Pittieri*. The author has examined specimens from Ambato, Ecuador, where it was found in 1918 both on potatoes and tomatoes. For this rust only one kind of spore, the teleutospore, is produced in the life cycle, and these germinate at once upon reaching maturity, requiring no resting stage.

814 – ***Rosellinia Pepo*, an Ascomycete Injurious to Cacao in Trinidad, West Indies.** — NOWELL W., with introductory note by. FREEMAN W. B, in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVIII, Pt. 4, pp. 178-199, figs. 5. Port of Spain, 1920.

Several species of the genus *Rosellinia* give rise to a well-defined type of root disease in numerous countries in the world, both temperate and tropical. The fungus destroys cultivated trees and shrubs in patches,

and often infests the soil and destroys practically all the vegetation with which it comes in contact.

In the Lesser Antilles, *Rosellinia* diseases occur in Guadeloupe, Domenica, Martinique, St. Lucia, St. Vincent and Grenada; they are unknown in the remaining islands of the group, which have drier climates.

The range of hosts is extremely wide, including practically all the important cultivated and semi-cultivated plants, but the plants most affected are cacao (in all the islands), coffee (in Guadeloupe and Martinique), limes (*Citrus aurantifolia*; on new clearings in Domenica), and arrow root (*Maranta arundinacea* in the interior districts of St. Vincent.

The disease on cacao is usually caused by the species *R. Pepo*, and in most cases, is communicated from the roots of dead or dying shade trees, especially breadfruit (*Artocarpus incisa*), avocado (*Persea gratissima*), and pois-doux (*Inga* spp.). Another species of *Rosellinia*, as yet unidentified, is believed to attack cacao in certain localities.

The death of cacao trees from root disease has been known in Trinidad and Tobago for a long time, but the cause of death does not appear to have been specially investigated.

Although *Rosellinia* had not previously been recorded as a cause of root disease of cacao, etc., in Trinidad and Tobago, Mr. NOWELL, during his visit in 1918 to this Colony, expressed an opinion that this fungus was likely to be found on these two islands, considering its wide distribution in the West Indies and tropical America.

During a second visit in 1919, Mr. NOWELL, accompanied by Mr. FREEMAN visited an estate where trees in a particular area had died. An examination of the dead trees led to a diagnosis of the cause of the disease as *R. Pepo*.

The disease on *Citrus aurantifolia* and coffee is caused by *R. Pepo* and *R. bunodes* indifferently.

The first cases in new clearings are usually associated with forest stumps left to decay, especially those of certain trees. Subsequent cases arise from the spread of the fungus from tree to tree along the roots, or by infection from surface soil rich in decaying vegetable matter, which readily becomes infected in damp and shaded situations.

An infected tree may be killed gradually by the progressive investment of the roots, or rather quickly by the destruction of the bark around the collar. The fungus penetrates both bark and wood. Conidia are produced with great readiness wherever the mycelium emerges into the open; perithecia occur later, and, especially in the case of *R. Pepo*, their formation may be much delayed.

Much can be done to prevent outbreaks of the disease by exposing the soil, the bases of the trees, and other dead material lying about to the wind and sun. Cases which may arise may be restricted by these measures and by the provision of a close system of trenches to prevent root contact.

Treatment by excision and exposure is successful in the early stage of infection, but in practice these are hardly ever detected. Periodical surveys would save many trees.

Infected trees should first be flamed and then promptly removed, all roots dug out and burnt, the soil limed, and the situation exposed as much as possible. All adjacent trees should be isolated from each other by trenches.

815 - ***Phytophthora Cactorum*, Injurious to Pears in Nova Scotia.** — *The Agricultural Gazette of Canada*, Vol. VI, No. 11, pp. 951-952, figs. 1. Ottawa, November, 1919.

In September, 1919, specimens of pears were received from Kentville, Nova Scotia, which showed a rather unusual rot.

The nearly full grown pears showed one or more large, circular, dark-brown spots, resembling the common soft rots, but unusual, because the spots were not soft but quite firm. The pears of one tree only were affected, and on microscopic examination it was found to be due to the fungus *Phytophthora Cactorum* (Leb. and Cohn) Schr. This disease of pears is new to the continent of America. In the few cases where it has been observed, the fruit is affected only on low hanging branches. This fact suggests that the infection may originate from surrounding infected vegetation. In the early stages, the rot does not extent very deeply into the tissues, but soon a large number of other organisms appear — bacteria and fungi — and the pear becomes a soft rotten mass.

The fungus reproduces by zoospores and oospores.

As control measures, it is advised to prevent branches loaded with pears from hanging low and to prop them up. All fruits showing such or similar rots should be carefully collected and burnt, particularly any that may have fallen to the ground. The weeds should be kept down around the trees, so that the fungus may find no host plant near the trees. Fruits and other infected material allowed to fall to the ground are certain to perpetuate the disease.

WEEDS AND PARASITIC FLOWERING PLANTS

816 - **Undetermined Larvae Attacking the Orobanche of the Bean, in Italy.** — Sciacca N., in *La Propaganda Agricola*, Series 2, Year XII, Nos. 9-10, pp. 126-128, Bari, May, 1920.

The author noticed that, in the field of the Bari Agricultural Experiment Station, in some plots of beans, more or less attacked by Orobanche, there were some individuals which, although they were infested by the parasite, still looked healthy and did not shed their "jumping" fruits. On the other hand, certain beans, also hosts of the Orobanche, had already been much injured by this parasite. While, however, the Orobanche plants living on beans that had lost their flowers and fruit, were healthy and difficult to uproot, those infesting healthy-looking beans were wilted and were easily pulled up, the swollen portion of their stem being completely rotten.

On cutting sections through the stalk of one of these diseased Orobanche, one or more galleries were seen running its whole length. These were inhabited by a larger, or smaller, number of white, apodous larvae

from 5 to 8 mm. long, and very agile. The galleries begin in the swollen portion of the stem of the Orobanche, and present as many ramifications as there are flowers. Each ovary contains one or more larvae. The latter, after having destroyed all the ovules, remain in the flowers in the form of dark yellow nymphs from 2 to 3 mm. in length. So intense was the infestation, that not one flower of a diseased Orobanche was spared; the little enemy made its way from below, and never rested till it reached the flower which was always faded, and sometimes decomposed.

The author extended his investigations to other bean fields, and reached the district of Cassano. He found, that wherever the Orobanche grows, its parasite is found more or less plentifully. Many local agriculturists said that they had also seen these larvae in the past, but they attributed no importance to them, and never noticed that all the withered Orobanche were to be found on bean-plants that were little, or not at all, injured.

The parasite was also observed in 1905, by Prof. C. CAMPBELL, in the Cassino district, and the attention of entomologists was drawn to it as being a means of controlling Orobanche. Prof. G. LO PRIORE also found the parasite in Sicily, and published his discovery in 1914.

Of all the methods suggested for controlling Orobanche, the most certain and thorough is the systematic destruction of the flowers. If this does not save the bean crop of that year, it hinders the parasitic phanerogam from spreading and reproducing itself in subsequent seasons. If the work of destroying the flowers could be entrusted to the animal parasite in question, a very economical and generally applicable system of controlling the Orobanche would have been found, and at the same time, the propagation of the natural enemy of that plant would be encouraged, instead of impeded. It should be noted, that the larvae do not only destroy the haustoria and seeds of their host, but aso the little tubers that develop on the swollen part of the stem, thus depriving the plant of all means of reproduction.

Many southern, especially Sicilian, agriculturists plant their beans late, with a view to controlling the Orobanche. The author suggests that possibly one of the reasons for the success of this practice may be found in the fact that the late development of the beans, and consequently of the Orobanche, offers the most favourable conditions for the growth and attack of the larvae.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERAL

817 – **Insects Injurious to Economic Crops in the Zanzibar Protectorate.** — MANSFIELD-ADERS, W., in the *Bulletin of Entomological Research*, Vol. X, Pt. 2, pp. 145-155, pl. 3. London, Jan., 1920.

The injurious insects mentioned in this list attack the following crops: —

Eugenia caryophyllata. — A certain number of young clove trees have been killed by *Termes bellicosus*, in the isle of Pemba. The same insect attacks the bark of unhealthy full-grown trees.

COCONUTS. — The most serious pests throught the islands of Zanzibar and Pemba are *Oryctes monoceros* and *O. boas.* Trees from 2 ½ to 3 years old are most usually attacked, many are killed, others greatly delayed in reaching maturity. Trees in isolated positions and on bad soil are more often attacked. Fully matured trees harbour adult beetles, but are not seriously damaged. The most useful preventive measure is the trapping of larvae in pits filled with rotting coconut trunks, vegetable debris, and a little horse manure. No insect have been found preying on the eggs, larvae, pupae or adults of the two *Oryctes.* The larvae are destroyed by certain mammals, including *Rhynchocyon adersi, Petrodomus sultan, Pachyura murina,* and two species of crows, *Corvus scapulatus* and *C. splendens.*

The following are minor pests of coconut palm :— *Aspidiotus destructor, A. cyanophylli, A. lataniae, Hemichionaspis minor, Cerataphis lataniae, Rhina amplicollis, Diocalandra frumenti, Rhyncophorus phoenicis,* and *Termes bellicosus.*

COTTON . — Attacked by *Pectinophora* (*Gelechia*) *gossypiella, Pyroderces simplex, Earias insulana, Sylepta derogata, Prodenia litura, Acrocercops bifasciata, Bucculatrix loxoptila, Orgyia vetusta, Euproctis producta, Dysdercus fasciatus, D. superstitiosus, Oxycarenus albidipennis, Pseudococcus obtusus, Ps. virgatus,* and *Ps. citri.*

CEREALS. — Maize is attacked by *Cirphis loreyi, Sesamia calamistis, Chilo suppressalis* and *Peregrinus maydis ;* except the last, all the other insects quoted feed also on *Sorghum vulgare* which is also attacked by *Busseola fusca.*

VEGETABLES. — Cabbages are attacked by *Crocidolomia binotalis, Plutella maculipennis, Phytometra signata ;* egg-plants by *Acanthocoris fasciculatus ;* Cucurbitaceae by *Dacus vertebratus, D. brevistylus* and *D. punctatifrons ;* pigeon-peas (*Cajanus indicus*) by *Pseudococcus obtusus, Tragocephala variegata, Lyprops breviusculus, Mylabris dicincta, M. amplectens, Coryna ambigua, Marasmarcha atomosa, Deudorix antalus,* and *Agromyza* sp. ; *Hibiscus esculentus* by *Pectinophora gossypiella, Earias insulana, Sylepta derogata, Prodenia litura,* and *Nisotra weisei ;* sweet potato (*Ipomoea batatas*) by *Cylas formicarius* and *Aspidomorpha punticosta ;* and cassava (*Manihot utilissima*) by *Pseudococcus* (*Dactylopius*) *virgatus* var. *madagascariensis.*

FRUIT TREES. — Citrus plants are injured by *Lepidosaphes beckii, Icerya purchasi, I. seychellarum, Pseudococcus obtusus, Ps. citri, Ceroplastes rubens, Coccus viridis, Aspidiotus trilobitiformis, Cerataphis lataniae, Aphis tavaresi, Argyroploce leucotreta, Papilio demoleus, Tragocephala variegata, Porphyronota maculatissima, Gyponychus cervinus,* and *Ceratitis capitata ;* mangos by *Sternochetus* (*Cryptorrhynchus*) *mangiferae, Aspidiotus* (*Chrysomphalus*) *dictyospermi, A. destructor, Pseudococcus obtusus, Lecanium adersi, L.* (*Saissetia*) *nigrum, L.* (*Saissetia*) *punctuliferum ;* bananas by *A. destructor ;* and *Anona muricata* by *Ceratitis rosa.*

SHADE TREES. — The African almond (*Terminalia catappa,* is occasionally severely attacked by bag worms (*Psychidae*), and less severely

by *Miresa melanosticta ; Casuarina equisetifolia* by *Cirina forda* and *Pseudococcus obtusus ;* cinnamon trees by *Asura saginaria ; Ficus elastica* by *Aspidiotus* (*Pseudaonidia*) *trilobitiformis* ; silk cotton (*Eriodendron anfractuosum*) by *Dysdercus superstitiosus* and *D. fasciatus.*

TIMBER. — Various woods are damaged by *Macrotoma palmata, Dinoderus minutus* and *Termes bellicosus.*

MISCELLANEOUS PLANTS. — The castor plant is attacked by *Thalassoides digressa, Duomitus capensis, Eutyposis impressa* and *Chrotogonus hemipterus ; Amaryllis* sp. by *Brithys pancratii* and *Brachycerus atrox ; Ipomoea* sp. by *Euchromia formosa ;* gardenias by *Glyphodes sericea ;* roses by *Mausoleopis amabilis* and *Aspidiotus* (*Chrysomphalus*) *aonidum ;* and various ornamental creepers by *Pseudococcus virgatus.*

STORED PRODUCTS. — The following injurious insects are mentioned : — *Calandra oryzae* in rice, maize and sorghum ; *Laemophloeus pusillus* in maize ; *Tribolium castaneum* in maize and occasionally in rice ; *Silvanus surinamensis* in maize ; *Tenebriomaides uritanicus,* occasional pest in maize ; *Bruchus chinensis,* serious pest, especially of *Phaseolus Mungo,* and *Cajanus indicus ; Cossonus suturalis,* occasional pest of sweet potatoes ; *Latheticus oryzae* and *Rhizopertha dominica,* occasional pest of maize : *Necrobia rufipes* in dried copra ; and *Ephestia cautella* in rice and various flours.

818 – **Weevils Injurious to Certain Cultivated Plants in South Africa.** — MARSHALL, G. A. K., in the *Bulletin of Entomological Research,* Vol. X, Pt. 3, pp. 273-276, pl. 1. London, April, 1920.

A description of four hitherto undescribed species of *Curculionidae* sent to the Imperial Bureau of Entomology from the Division of Entomology, Pretoria :—

1) *Protostrophus planatus,* from East Rand, Transvaal, where it was recorded as injurious to the foliage of young orange trees.

2) *P. noxius,* from Clocolan, Orange Free State, found feeding on young wheat.

3) *P. instabilis,* from Nelspruit, Transvaal, also injurious to foliage of young orange trees.

4) *Eremnus horticola,* from Bloemfontein, Orange Free State, found feeding on dahlias and chrysanthemums.

MEANS OF PREVENTION AND CONTROL

819 – **Effect of Deleterious Gases on Insects.** — *Bulletin de la Société entomologique de France,* 1920, No. 5, p. 82. Paris, 1920.

CH. DEMAISON reports that, in the neighbourhood of Rheims, there was an apparent scarcity of insects during the year 1919. He imagines that the continuous distribution of gas in this district evidently has some effect and he calls attention to the interest of this question from the point of view of applied entomology.

820 – **The Insecticidal Properties of Different Parts of Pyrethrum *(Chrysanthemum cinerariaefolium).*** — See No. 757 of this *Review.*

821 – ***Chlorochroa sayi,* Grain Bug Injurious to Wheat and Other Crops in the United States.** — CAFFREY, D. J. and BARBER, G. W., in the *Department of Agriculture, Bulletin* 779, pp. 1-35 figs 13. Washington, D. C., 1919.

Since 1911, *Chlorochroa sayi*, Stål has caused serious damage to wheat and other crops in the inter-mountain and southwestern States. The most important damage is caused by the insect piercing the newly-formed heads of the cereals and feeding on the liquid content, which prevents the formation of the grain or greatly reduces its weight.

The reduction in yield from grain bug attack varies from 10 to 50 % of the crop. In extreme cases the entire crop may be destroyed.

The cultivation of large areas formerly devoted to grazing, eliminated the native food plants of the insect and caused it to attack cultivated plants, and resulted in an increase of the pest beyond its former abundance.

Wheat, barley, and rye are the cultivated crops most preferred by this bug. The species also feeds on other cereals, and on alfalfa, cotton peas, beans, cabbage, tomato, and lettuce, in addition to many wild native plants.

The first damage was recorded in 1903, and since that time serious attacks have been reported from most of the States west of the Great Plains area.

Weather and the work of parasites generally restrict destructive outbreaks in each locality to periodic intervals of two or three years.

Adults emerge from hibernation in the early spring and deposit eggs on the material composing the hibernating quarters. The resulting nymphs feed upon tender plants growing in their vicinity. Upon reaching maturity the adults migrate to cereal crops and feed upon the developing heads.

There are three distinct generations and sometimes a partial fourth generation annually. About 50 days are required to complete the life cycle of each generation. After midsummer, the numbers of the insects are greatly reduced by an egg parasite, *Telenomus ashmeadi*, and by two species *Gymnosoma fuliginosa* and *Ocypterodes euchenor* which parasitise the adults. Several kinds of predacious enemies contribute to the same result.

Hibernation occurs in the adult stage under weeds or rubbish. No nymphs or eggs survive the winter. Severe winters result in the death of a large number of hibernating adults and constitute one of the most important factors in restricting destructive outbreaks of this species. During normal winters, at least 95 % of the adults survive when hibernating in protected places.

The most effective and practical method of control is the destruction of the adults while concentrated in their winter quarters. This is best accomplished by turning under or burning all rubbish and weeds (particularly Russian thistle, *Salsola Tragus*) in and about cultivated fields.

Trap crops, hand picking and hopperdozers (1) might prove practical in the control of the insect under special conditions.

(1) For the apparatus, employed in America in the control of locust attacks, see « *La lutte contre les sauterelles dans les divers pays,* », Inst. Internat. Agric., Rome, 1916, pp. 142-143. (*Ed.*)

822 – ***Lecerfia chitinipyga* n. gen., and n. sp., a Macrolepidopteron found on the Grass *Aristida pungens* on the Algerian Sahara.** — DUMONT, C. in the *Bulletin de la Société entomologique de France*, 1920, No. 6 pp. 102-104, figs. 1. Paris, 1920.

A morphological description of the adult, larva and pupa of a Macrolepidopteron (fam. *Noctuidae*) found in 1919 in the Algerian Sahara (Western Grand Erg, west of El Golea), and which the writer has designated by the name of *Lecerfia chitinipyga* n. gen. and n. sp.

The caterpillar lives on the panicles of *Aristida pungens* Desf. (the "drin" of the Arabs), and eats the caryopses of that plant.

823 – **Insects Injurious to Cotton in Porto Rico.** — SMYTH, E. GRAYWOOD, in *Entomological News*, Vol. XXXI, No. 5, pp. 121-125. Lancaster, Pa., May, 1920.

Pyroderces rileyi Wals, although frequently found, does no perceptible damage.

On the contrary, *Alabama argillacea* often becomes a serious menace to cotton production. As the use of arsenical insecticides is too expensive for the average cotton grower of the Island, he is advised to use a much cheaper but equally effective method of control, namely, to cut down and destroy the moth's wild food-plants growing between the cotton crops. The principal host plants of this moth are two weeds, *Urena lobata* and *Malachra rotundifolia*, both Malvaceae, the former much the more abundant and the more noxious, owing to its habit of attracting large numbers of the ant, *Solenopsis germinata* Fabr., because of the three small honey ducts on the underside of each leaf. Unfortunately, this weed is considered highly medicinal by the natives, and with difficulty can they be persuaded to destroy it ; if left alone, *U. lobata* grows vigorously. On July 15, 1916, the author was able to collect as many as 52 larvae from four plants, showing how the weed may facilitate the spread of the moth.

Dysdercus andreae L. is sometimes abundant and at other times entirely absent, so that it cannot on the whole be considered as a serious cotton pest.

An occasional larva of the cutworm, *Xylomiges sunia* Guen. has been seen attacking cotton foliage.

The Greenhouse thrips, *Heliothrips haemorrhoidalis* Burm., has done much damage according to the author, but it had not been previously reported as a cotton pest.

Another insect that is very common, and infests probably 30 % of the cotton bolls, is the mealybug, *Pseudococcus virgatus* (Ckll.), which occurs in all stages of its development. It is believed that this beetle is heavily parasitised by a Cecidomyid, probably *Karschomyia cocci* Felt.

A very few specimens of *Ps. citri* (Risso), one specimen of *Ps. longispinus* (Targ.) and a number of adults of a beetle very analagous to *Coccus mangiferae* (Green) were also found on the bolls.

Leaves of the Malvaceae have been occasionally found to be attacked by the lace-bug, *Corythuca gossypii* F.

More important than the last mentioned species is the cotton aphis, *Aphis gossypii* Glov., although the attack is light and scattered, thanks to the activity of its natural enemies, amongst which may be quoted, in

order of importance, *Cycloneda sanguinea* L., *Scymnus roseicollis* Muls., *Acrostalagmus albus*, a Braconid, a Chalcidid, a Chrysopid, and a species of Hyperaspis. In very wet weather, *A. albus* usually becomes the most efficient of the parasites. *C. sanguinea* is greatly hampered in its multiplication by the attack of a hyperparasite (*Homalotylus* sp).

The adults of *Diabrotica graminea* Balz. are often seen eating cotton blossoms or foliage, and the larvae doubtless attack the roots.

Occasional nymphs and adults of the species *Empoasca* have been found on foliage and bolls.

Two adults of *Antianthe expansa* (Germ.), one adult of the species *Agallia*, and a few adults of *Oliaris* sp. have been found on cotton stems.

The nymphs of the green bug *Nezara viridula* (Linn.) were noticed for the first time in 1919 on many cotton bolls.

Lepidopterous larvae of small size have been found also on the bolls; none of them, however, resemble the treacherous pink bollworm (*Pectinophora* (*Gelechia*) *gossypiella* Saund.

824 - ***Strategus quadrifoveatus*, a Coleoptoron Injurious to the Coco Palm in Porto Rico.** — CRESPO, M. A., in *Revista de Agricultura de Puerto Rico*, Vol. IV, No. 3, pp. 47-48. San Juan, P. R., 1920.

Strategus quadrifoveatus ("escarabajo rinoceronte") is, at the present time, causing much havoc among young coconut palms in the island of Porto Rico. During the day, the adult beetle lies hidden in the soil surrounding the stem of the palms. The larvae are found hiding in the dead palms, on which they live, or in dry or rotten stakes, etc.

The insect undergoes complete metamorphosis, its life cycle lasting from twelve to thirteen months.

S. quadrifoveatus injuries the coco-palm by excavating a deep gallery in the stem while it is still young. The author has seen eight of these insects round a coco-palm a year and a half old, which was almost completely destroyed by the attacks of the pest. It has often been observed that sugar-canes growing in the neighbourhood of young coco-palms have also been injured.

The best way of killing these beetles is to attract them into piles of dry rotten stakes, heaps of coco-nut debris, or any similar places where they can find food. These traps should be visited at least once a month and the larvae destroyed.

When young coco-palms are attacked by *S. quadrifoveatus*, the leaves turn yellow, cease growing, and the plant finally dies. It is a good plan to dig round the palms to a certain depth, as soon as there is any suspicion of their having been infected.

All the beetles found must be collected and killed by sprinkling them with paraffin or paraffin emulsion. Further, all rubbish that might serve as a hiding-place for the insect must be removed from the plantation.

INJURIOUS VERTEBRATES

825 – ***Merops philippinus*, a Bird which Destroys Beneficial Insects in India.** — FLETCHER, T. B. and INGLIS, C. M. in *The Agricultural Journal of India*, Vol. XV., Pt. 2, pp. 121-123, pl 1. Calcutta, March, 1920.

Merops philippinus (blue-tailed bee-eater) is common throughout the plains of India, but is partially migratory, visiting Northern India in summer and Southern India in winter. In Bihar they are seen from March to October, and in the Duars have only been noticed during June and July.

It has only been encountered once in North Cachar, but is common in Pusa. C. W. MASON, after an examination of the stomachs of 13 birds between April and October, states that of the 83 insects taken by *M. philippinus*, 70 were beneficial, 3 injurious and 10 neutral. The beneficial insects included dragonflies (*Odonata*), bees and other Hymenoptera.

[825]

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BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

826 – **Forests, Stock Breeding and Agriculture in Upper Mesopotamia.** — NAAYEM, J. (Delegate for Chaldea), in La Haute Mésopotamie et ses richesses naturelles, *Chimie et Industrie*, Vol. III, No. 5, pp. 684-688, Maps 1. Paris, May, 1920.

DÉVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

Upper Mesopotamia includes the two provinces, or vilayets, of Diarbekr and Mosul, which are situated between the Tigris and the Euphrates; adjoining Mosul, lies territory extending from the left bank of the Tigris to Persia.

Although the area of the country is about 200 000 sq. km., there are not more than 1 500 000 inhabitants or about 7 inhabitants per sq. km.

The numerous and magnificent forests that formerly clothed the banks of the Tigris in Upper Mesopotamia now no longer exist as they were distroyed owing to bad management. However, on the banks of both the large rivers, forests are still met with at intervals, and serve as a source of fuel for the neighbouring population. In the mountain of Karadjdagh, and in the neighbourhood of Souverek, there are still forests where charcoal is made; all the mountains extending from Mardin to Djezire are also completely covered with woods.

It was from these mountains, that the Naazem Bros. procured during the war, when coal was scarce, all the wood required by the Bagd..d Railway Co. for the construction and working of the l'ne running from Arrada to Demir-Kapon beyond Nisibin.

Upper Mesopotamia may be termed a cattle-breeding country *par excellence*. Its splendid pastures and vast prai ies covered with succulent grass serve as camping-grounds for the nomadic tribes that pitch

their tents there, and breed for export large flocks of sheep and goats and herds of camels. They also derive much profit from the butter, cheese and wool that are produced. In the summer when the "rahil" (journey) takes place, the natives leave the plains and drive their stock to the Kardjdagh and Zorane mountains, where the permanent and luxuriant vegetation provides them with ample food. By enlarging the irrigation works, and thus obtaining a sufficient water supply during the summer for the pastures, it would be possible to save the animals these long migrations, that only fatigue them and make them lose flesh.

Goats and sheep form the chief live stock; they are exported, and also supply the country with meat. In the departments of Ourfa alone, there are about 1 000 000 of these animals.

The Mesopotamian draught-oxen and milch-kine are, as a rule, smaller than the French varieties. The Arab horse is also bred in Mesopotamia, an active centre for trade in this breed, which has been kept very pure.

The production of horses could easily be increased, and the animals improved, by the creation of Stud Stations, and by importing European varieties for crossing with the native ones, interesting results from every point of view could be obtained. The mule and donkey are used to draw the plough and large numbers are exported.

Although the methods of cultivation adopted are rudimentary, and the agricultural processes and implements very primitive, yet the soil of Mesopotamia, consisting of fine, friable alluvium, produces splendid crops. The Arab peasant, who is a person of fixed and careless habits, after having put some of the seed apart for his own use, throws the rest on the field somewhat at random, covering it more or less with the plough, so that a certain amount is eaten by the birds.

As soon as the ear is formed, the horse, the farmer, and his oxen, etc., use the crop for food, and this continues until the theshing which lasts two months, and is carried out by beasts of burden that tread out the ears, or drag over it a plank weighted down with stones. During harvesting, which is done with a sickle, the reapers are obliged to leave the ears that fall to the gleaners, who are often as numerous as the reapers, and return home in the evening with 10 to 15 kg. of grain. Before dividing the crop between the landowner and himself, the agriculturist tries to steal as much of it as possible, and the landowner is obliged to resign himself to this. In spite of these losses, and of the Government tax, which amounts to $^1/_7$, and often to more, the grain that falls to the lot of the landowner is 5 times, and sometimes ten, or fifteen times, the amount of the seed-corn sown. The crops would be much larger if modern and improved agricultural implements were obtainable, and if scientific cultural methods were adopted under the direction and vigilant eye of an expert engineer. Careless and dishonest manual labour could be replaced by motor-cultivation the success of which is assured by the proximity of rich petroleum wells. Enormous tracts of land now lying incultivated, could then be turned to account, and would thus be-

nefit, not only the owner and the population, but also the capitalist, who could find no better manner of rapidly increasing his wealth.

Everything grows and suceeds well on this soil, including crops such as, wheat barley, maize, rye, rice, lentils, chickpeas, sesame, tobacco, cotton, etc. All the fruits and vegetables of both hot and temperate climates — pears, apples, figs, apricots, peaches, mulberries, olives, etc. — yield good crops in Mesopotamia. The pomegranates of Ourfa are without rivals, the cherries and plums of Mardin are exquisite, the melons and water-melons (the latter weigh sometimes as much as 50 kg.) are perfumed and their flavour and delicacy are unusual. Cucumbers, artichokes, asparagus, beans, haricots, cabbages, cauliflowers, " corne grecque," tomatoes, eggfruits, capsicums, carrots, turnips, beetrots, onions, and lettuces are abundant. Potatoes do well and may later become an important crop.

The vine, however, is of chief importance owing to its innumerable varieties ; much of the fruit is exported in the form of raisins. Well-cultivated vineyards with favourable exposures cover the temperate plains stretching between Ourfa and Diarbekr, and the mountains of Mardin, Djebel-el-Tour and Sindjar. There are thousands of hectares of uncleared land veéy suitable for vine-growing, and only requiring a little care in order to turn it into vineyards. Nothing is wanting for the establishment of a large wine industry, the products of which would find a sale on the markets of Aleppo. Mosul, Bagdad, Bassorah, and India.

The olive also grows in Mesopotamia, and might give rise to an important industry. The methods employed in the country are still very primitive ; it would be worth while to set up modern mills and apparatus for expressing all the oil from the cakes ; in this way a far larger yield of oil would be obtained than from the very rudimentary presses which are always used (1).

27 - **Phosphorus Requirement for the Maintenance of Man.** — SHERMAN, C. with the Cooperation of ROSE, A. R., KOCH, M., MATHEWS, E. and OSTERBERG, E. in *The Journal of Biological Chemistry*, Vol. XLI, No. 2, pp. 173-179. Baltimore, M. D., Feb. 1920. RURAL HYGIENE

For convenience of comparison, the data of the six experiments made by the author and his collaborators, and of all available previously published experiments which seem to be quantitatively comparable, have been calculated to the uniform basis of phosphorus output per day per 70 kilos of body weight

Out of the 95 experiments taken as a whole, 34 were made with men and 61 with women. The quantity of phosphorus required per day ranges from a minimum of 0.52 to a maximum of 1.2 gm., with an average of 0.88 gm. per 70 kg. of body weight. The experiments upon men average 0.87 gm. and those upon women 0.89 gm. per 70 kg. per day. The author considers that the variations in the phosphorous output may be due to the function of the phosphates in the maintenance of neut-

(1) See also *R.*, 1919, No. 552. (*Ed.*)

rality in the body, and to the possible differences in quantitative efficiency in nutrition of the various phosphorus compounds.

The author considers that while several factors determining the phosphorus output remain for further quantitative investigation, we are probably justified in concluding that the phosphorus requirement is now known with about the same degree of accuracy as the protein requirement, and that about $^1/_5$ to $^1/_{10}$ as much phosphorus as of protein is required in the maintenance metabolism of man.

If the quantity actually required for maintenance, is compared with the quantity of food supplies of 224 families or other groups of people selected as typical of the population of different parts of the United States, only 8 showed less than 0.88 gm. of phosphorus per man per day, and in all but two of these cases the phosphorus would have reached this figure if the food had been sufficient in amount to adequately cover the energy requirement per day. These two cases which are typical of the Southern United States according to the author, confirm the results obtained by McCollum and others indicating that the diets which resulted in pellagra in the Southern States lacked phosphorus content.

With this exception, the author considers that the danger that a freely chosen American diet will be deficient in either protein or phosphorus does not appear serious so far as the maintenance requirements are concerned. What quantities of phosphorus in the food will best meet the requirements of growth, pregnancy and lactation, remains yet to be determined.

828 – **Digestibility of Certain Vegetable Fats.** — Holmes, A. D. and Deuel, H. J. in the *Journal of Biological Chemistry*. Vol. XLI, No. 2, pp. 227-235, bigliogr. of 5 works. Baltimore, M. D., Feb. 1920.

Results of experiments on the average digestibility of diet are shown in the appended Table.

The digestibility of the protein and carbohydrate of the entire ration was essentially the same as that in other experiments of a similar

Average Digestibility of Diet and Estimated Digestibility of Fats Studied.

King of Fat	Digestibility of Entire Ration				Estimated Digestibility of Fats
	Protein %	Fat %	Carbohydrates %	Ash %	%
Avocado (*Persea gratissima*)	85.8	90.0	97.0	74.9	87.9
Cohune Oil (*Attalea Cohune*)	63.5	94.6	95.8	73.3	99.1
Cupuassú (*Theobroma grandiflora*)	75.2	88.8	96.6	55.8	94.1
Hempseed Oil (*Cannabis sativa*)	67.1	94.4	97.0	68.2	98.5
Palm-Kernel Oil (*Elaeis guineensis*)	61.0	95.3	96.9	56.5	98.0
Poppy-seed Oil (*Papaver album* and *P. nigrum*)	49.1	91.3	96.5	50.2	96.3

nature, indicating that the fats exercised no unusual effect on the utilisation of these constituents.

These fats and oils, with the possible exception of cupuassú fat, produced no abnormal physiological effects and may be regarded as satisfactory for food purposes. Cohune, hempseed, palm kernel and poppy seed oils are very nourishing to the human body.

829 – **The Destruction of Anopheles Larvae by Means of Powdered Trioxymethylene.** — ROUBAUD, E., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, p. 1521, and Vol. CLXXI, No. 1, pp. 51-52. Paris, 1920.

Trioxymethylene when powdered is very useful in destroying Anopheles larvae. It is the formaldehyde fumes given off by the particles of the powder that react on the insects, as, if the fumes are dissolved in water after an exposure of a few seconds the powder becomes inactive. Therefore, it is only possible to count upon the efficacy of the remedy at the very moment of its application.

If the powder is in an inactive condition, or is ingested in too small a quantity, it does not kill the larvae, but on the contrary, renders, them immune to trioxymethylene. This rapid immunisation does not, however, last longer than a week, if the insects are once more under normal conditions. The powder must not be applied too frequently, and an interval of at least a week should be allowed to elapse between each application.

Even small doses, in the end, destroy the larvae almost infallibly, for their power of resistance being weakened, they fall a prey to their natural enemies, carnivorous insects, etc.

The effects of trioxymethylene powder upon Anopheles larvae are as follows: (1) Neurotoxic action soon causing total paralysis; (2) the preservation of the dead tissues, which are able to resist the attacks of putrefactive bacteria for some weeks.

AGRICULTURAL INSTITUTION

830 – **"Ecole Supérieure" of the Rural Engineering in Paris.** — PATRIX, L. (Assistant Director, of the "Ecole"), in *Journal d'Agriculture pratique*, Year LXXXIV, No. 25, pp. 476-477. Paris, June 17, 1920.

The "École supérieure de Génie rural" was founded at Paris by the Decree of August 5, 1919, and opened on October 1 last. Its objects are: (1) To obtain recruits for the Corps of Rural Engineers which is under the Direction Générale des Eaux et Forêts, and was created by the decrees of April 5, 1903, and December 26, 1918; (2) to provide technical instruction for French, or foreign unattached students desirous of obtaining the diploma of Rural Civil Engineer.

The engineering students of the State Service are drawn from the students leaving the Paris National Agricultural Institute according to their place on the lists, and subject to certain conditions regarding the marks gained in various subjects. The unattached students are admitted to a competitive examination based upon the subjects taught in the agricultural and mathematical courses in the above-mentioned Agricultural Institute.

The instruction given in this École supérieure greatly exceeds the limits of what is commonly understood as rural engineering, which merely deals with agricultural machines and buildings.

In fact, it includes all the technical knowledge required of the engineer in matters relating to agriculture, and the centres of rural population.

Among the duties entrusted to the corps of Rural Engineers the author mentions: The agricultural utilisation of water; the irrigation, drainage, and reclaiming of land; the re-adjustment and exchange of small scattered holdings; the improvement of uncultivated land, marshes, peat-moors, salt-marshes, etc.; making country roads, bridges, foot-bridges, acqueducts, etc.; farm roads; various agricultural buildings; the construction of cheap houses for agricultural labourers and small farmers; rural industries (carpentry, etc.); the installation of co-operative factories; agricultural cable-ways, agricultural bascule bridges; supplying water to villages; the utilisation of waterfalls for the requirements of farms; rural hydro-electric installations and rural networks for the distribution of electricity.

The engineering course lasts two years. The instruction consists in class-teaching, lectures, and practical work carried out at the Station of Agricultural Hydraulics and of Rural Engineering, and is completed by excursions, visits to industrial establishments and residence. The courses and the lectures deal with the following subjects:

I. — *Course.* — Theoretical Analyses and Mechanics, Applied Mechanics, Hydraulics, Electrotechnics, Topography, Building and Construction, Canals, Roads, Bridges, Rural Jurisprudence and Administration.

II. *Lectures.* — Drawing plans; Officer work and Book-Keeping, Practical Work, Testing Materials. The Value of Property; its Valuation. Re-adjustment of holdings. Study of water storage and making mountain reservoirs, Rural Buildings. Motorcultivation, Agricultural Industries. General Comparative Agriculture.

The practical work consists in testing materials and machines, electrical engineering, making drawings and plans, etc.

Electricity, which is of ever-increasing importance in the economic field, is called upon to render the greatest services to agriculture and to transform the conditions under which the rural population live. Therefore, in order that the Rural Engineers may be authorities in the matter of electric plant, it has been decided that, during their second year, the students shall attend courses at the College of Electrical Engineering (*École supérieure d'Electricité*) and take the diploma of Electrical Engineer.

EXPERIMENTAL AND ANALYTICAL WORK

831 - **The Relation of Size, Shape and Number of Replications of Plots to Probable Error in Field Experimentation.** — Day, J. W. (Oklahoma Agricultural and Mechanical College, Stillwater, Okla.) in *Journal of the American Society of Agronomy*, Vol. 12, No. 3, pp. 100-105. Lancaster., Pa., March, 1920.

Results of experiments obtained at Missouri Agricultural Experiment Station on a plot of approximately ¼ acre in extent situated on silt loam and apparently very uniform throughout. In the autumn of 1916, wheat was sown in 100 rows, 8 inches apart, and 155 ft. in length.

The following June, the wheat was harvested in 5-ft. row segments, and the yield of grain and of straw was recorded for each unit. There were, therefore, 3 109 units available for study. A calculation was first made to determine the direction in which the greatest variation in yield existed, both in and between the various rows; followed by a study of the relation of size of plot to variation in yield.

From the results obtained, it is evident that by increasing the size of the plot to at least $^1/_{20}$ acre and probably much beyond, variation is reduced. The shape of the plot has also an important effect on variation that up to the present has been overlooked or misunderstood. More accurate results are obtained from long and narrow plots and the longer the plot the more accurate the result. Square plots or approximately square are to be preferred to long narrow plots that have their greatest dimensions in the direction of least variation.

The results from single plots are usually not sufficiently accurate to determine small differences between varieties or between fertiliser or cultural treatments. The use of a unit of comparison composed of systematically distributed parts, gives results much less variable than those obtained from an equal area in a single plot.

An increase in the number of replications of a plot of given size increases the accuracy of the results. When the number of replications remains constant, but the size of the plot replicated is increased, variation is reduced. The most effective replicated group from the point of view of shape, is one that is long and narrow, and has its greatest dimension in the direction of greatest variations.

832 - **Horticultural Exibition and Garden Competitions.** — Mulford, F. L. (Office of Horticultural and Pomological Investigations), in *U. S. Department of Agriculture, Department Circular* No. 62, pp. 1-38, figs. 12 Washington, Oct. 1919. EXHIBITIONS

The author who is associated with the Bureau of Plant Industry, United States Department of Agriculture discusses horticultural exhibits from the following point of view: Organisation; competitors; classification; various kinds of shows; arrangement of exhibits and methods of judging (score card method); prizes; rules (example are quoted). The author concludes by a brief survey of garden competitions, and gives also an outline of the schedule system advised.

CROPS AND CULTIVATION

833 - **Temperature and Humidity Associated with the Sirocco in Palestine.** — Georgii, W., in *Monthly Weather Review*, Vol. XLVIII, No. 1, pp. 40. Washington, D. C., Jan. 1920. AGRICULTURAL METEOROLOGY

The sirocco winds of south-west Palestine originate in the desert of Arabia and are most frequent during the spring and autumn, especially during April, May, September and October. The period during which this very hot wind blows is from one to three days, and sometimes even longer and completely neutralises the effects of the sea breezes.

The unpleasantness of the sirocco is due to the extremely low relative humidity, and to the subsequent rise at the conclusion of the wind.

The following data on temperatures and humidity cover a period lasting from May 9 to 20, 1916.

		Shelter temperature °C			Psichrometre						Relative humidity			Extreme temperature °C	
					Dri bulb			Wet bulb							
		7 a. m.	9 p. m.	2 p. m.	7	2	9	7	2	9	7	2	6	maxima	minima
		°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
May	9	16.2	26.4	16.6	—	—	—	—	—	—	—	—	—	27.5	10.0
»	10	21.8	26.8	17.2	—	—	—	—	—	—	—	—	—	28.0	10.2
»	11	17.4	29.6	18.3	—	—	—	—	—	—	—	—	—	30.3	13.2
»	12	19.6	33.6	22.6	—	—	—	—	—	—	—	—	—	34.5	12.0
»	13	22.3	35.4	25.5	—	—	—	—	—	—	—	—	—	37.8	15.2
»	14	29.4	39.5	26.5	—	—	—	—	—	—	—	—	—	39.6	21.2
»	15	25.2	30.5	28.6	24.6	39.0	26.0	13.0	20.5	14.8	18	12	23	40.1	19.2
»	16	34.3	40.3	30.0	34.2	41.2	29.0	16.9	17.9	16.2	9	2	20	41.6	23.1
»	17	35.5	42.0	33.7	35.8	41.0	33.1	16.2	19.0	16.1	2	5	7	43.1	25.0
»	18	36,1	37.6	22.4	36.2	38.0	22.7	17.0	22,2	21.2	3	20	88	42.1	25.6
»	19	22.7	25.0	18.4	20.8	25.2	18.1	19.1	20.2	16.5	85	63	85	28.8	20.0
»	20	18.6	24.9	18.2	18.4	2.44	18.2	16.9	17.8	15.2	86	52	72	26.4	16.5

During the early part of May the temperatures were practically normal; the maximum lay between 26° and 29° C, and the minimum between 10° and 15° C. On the 11th however, the maximum reached 30.2° C which may be regarded as the first symptom of the approach of the sirocco The sudden rise of temperatures during the morning of the 12th, was followed by temperatures which gradually mounted higher and higher until the 17th, the highest point of the sirocco, and the temperature remained above 30° C from 5 a. m. until 11 p. m From the commencement of the sirocco the relative humidity was very low but on the 18th and 19th it mounted very rapidly.

The sudden change of temperature and humidity has an evident unfavourable effect on both animals and plants.

834 – **Cultivation does not Increase the Rainfall in the Great Plains States.** — Smith, J. W. in *Monthly Weather Review*, Vol. 47, No. 12, pp. 858-860, figs. 2 Washington, D. C., Dec. 1919.

It has been the general opinion amongst the farmers in the Great Plain States that the amount of land under cultivation influences the rainfall increase.

The author refutes this idea after taking note of numerous records.

The average precipitation in the northern Great Plains during the period 1868 to 1917 is recorded as follows:

1868-1877	19.8	in.
1878-1887	20.4	»
1888-1897	18.6	»
1898-1907	19.5	»
1908-1917	19.1	»

In the Central Great Plains:

1868-1877	16.3 in.
1878-1887	20.4 »
1888-1897	17.6 »
1898-1907	20.2 »
1909-1917	18.2 »

The data with reference the southern and western States are analogous. There are well defined sequences of dry and wet years, but there has been no progressive increase or decrease.

Thanks to the spread of dry farming and to the cultivation of varieties particularly resistant to drought, the acreage of certain grain crops in the Great Plains States is on the increase, as shown in the appending table, with reference to barley, maize, oats and wheat in the States of Kansas, Nebraska, Dakota, and Montana, during the years 1867, 1882, 1892 and 1917.

	1867	1882	1892	1917
	Acres	Acres	Acres	Acres
BARLEY				
Kansas	90	8 000	56 000	300 000
Nebraska	89	62 400	36 000	85 200
Dakota	—	11 200	128 000	1 148 000
Montana	—	740	2 012	360 000
MAIZE				
Kansas	2 622	188 000	628 800	3 662 000
Nebraska	4 591	160 000	646 000	3 696 000
Dakota	—	56 000	—	1 576 000
Montana	—	196	432	32 000
OATS				
Kansas	2 622	188 000	618 800	913 600
Nebraska	4 591	160 000	646 000	1 235 200
Dakota	—	56 000	469 000	1 800 000
Montana	—	11 200	25 529	272 000
WHEAT				
Kansas	35 600	629 200	1.628 800	1 494 800
Nebraska	4 000	662 800	501 200	39 880
Dakota	—	288 000	2 164 000	4 286 400
Montana	—	17 124	16 704	690 800

Comparison between the data referring to the cultivated areas and the temperatures, indicates that the effect of cultivation on the total precipitation must be negligible.

835 – **Influence of Sun-Spots and Rain-Fall upon the Growth of Annual Rings in Trees.** — DOUGLAS, A. E. in *Skogsvårds Föreningens Tidskrift*, Year XVIII, Parts. 5-6, pp. 165-168. Stockholm, June, 1920.

The author gives the results of a series of experiments carried out by him on different trees, with a view to ascertaining whether any cor-

relation exists between the growth and thickness of the annual rings of their wood, and periods of unusual solar activity (sun-spots) and other meteorological factors.

The first researches bore upon *Pinus ponderosa* growing in Arizona, where the dry climate would allow us to presuppose the existence of some connection between wood development and rainfall. The data collected during 43 years fully justified this expectation, and revealed a very high and positive correlation between the two values, the driest season being characterised by the reduced development of annual rings.

In making these researches, the total rainfall from one autumn to another was taken into account, so as to group together all the values corresponding to the vegetative period of the tree (winter rainfall + summer rainfall.)

The correlation would be still higher, if the accumulated moisture were reckoned (in the algebraic sum of the annual deviations) from the normal rainfall, beginning from the commencement of the growth period up to the year (inclusive) for which the correlation is to be determined.

The thickness curve of the annual rings is practically the same in regions very distant from one another, as for instance Prescott and Flagstaff in Arizona. The author suggests the possibility of distinguishing meteorological zones from these differences.

The results first having proved clearly positive, the experiments were extended to other trees and other countries: *Pinus douglasii, Sequoia, Abies canadensis* (in North America) and various species of *Pinus* and *Abies* (in Europe.)

From the comparative examination of very numerous growth curves, it was possible to determine periods of different length, of which the greater number seemed in direct connection with sun-spots:

Length of periods in years	Multiples of 11 (average duration of a period of sun-spots)
5-6	1/2
10-13	1
21-24	2
32-35	3
100-105	9

The last and longest period is especially show by sections of *Sequoia* trunks from the Sierra Nevada. These trees were 3000 years old (maximum 3077). The triple period (32-35 years, 3 times the period of the sun-spots), recurred with great exactitude (with a displacement of 3 years in 400), in a trunk from north of the Arctic circle in Norway, and in another from Arizona.

A double period of sun-spots was observed, not only in *Sequoia* from the Sierra Nevada, but also in sections from the centre of Norway. Single periods were met with most frequently and were seen in sections of *Pinus ponderosa* (500 years old) from Arizona, in those of *Sequoia* and were

very clearly marked in material (*Pinus Abies*) from the Baltic regions (Prussia and Sweden). Finally, periods of 5-6 years were also distinguishable in trunks of *Pinus ponderosa* from Arizona, as well as periods of only two years.

The following table may give some idea of the connection existing between the growth of annual rings and the prevalence of sun-spots.

Growt of wood		Sun-spots	
Years	Length of the period in years	Years	Length of the period in years
1595–1665	11,0 ± 0,5	1615,5–1660,0	11,1 ?
1661–1677	16 ?	1660,0–1675,0	15,0
1677–1770	12,5 and 10,8	1675,0–1769,7	10,5
1770–1793	9,0	1769,7–1788,1	9,2
1793–1817	?	1788,1–1816,4	14,15
1817–1910	11,6; 21,0 and 7,3	1816,4–1905	11,08

The author tries to explain these relations by presupposing the existence of a correlation between sun-spots and rainfall. This theory is, however, far from being proved, and is in any case very complicated; thus for instance, in certain parts of Norway, the maximum development of the annual rings is found to coincide with the minimum occurrence of sun-spots, whereas generally the exact opposite is to be observed.

836 – **Relation of the Weather to the Yield of Spring Wheat in Manitoba.**— Connor, A. J., in *Monthly Weather Review*, Vol. XLVII, No. 12, pp. 848. Washington, D. C., Dec. 1919.

The author presents the results of a series of agricultural meteorological investigations on wheat conducted at various experiment Stations in Manitoba, Canada. In every case, the plots were as near the meteorological instruments as feasible in order to render it possible to make parallel observations, an indispensable feature in this kind of research work.

With a view to obtaining accurate records of the critical periods concerning the various factors or meteorological phenomena, the vegetative period of the plant was divided into periods, taking into account the more important phases in growth.

1) Date of sowing.
2) Appearance above ground.
3) Stooling.
4) Earing.
5) Flowering.
6) Milk stage.
7) Complete maturity.
8) Cutting.
9) Average height of the plants every 7 days.

According to statistical formulae the correlations between the yield in grain and the biological and meteorological conditions, some noteworthy results have already been obtained.

(1) Basing his observations on the " critical period " theory, the author quotes the following as the true explanation of these phenomena: If, in the earlier stages of the growth of the wheat the weather is cool or rainy, earing is delayed and the subsequent yield is heavy; but if, on the contrary, the weather is warm and dry, earing is hastened and the subsequent yield is light.

(2) With regard to the rainfall the pluviometric values are grouped in 3 periods of 30 days beginning 30 days preceding sowing. With the exception of the fourth period, which corresponds to the final stages in growth, namely the ripening stage period, when dry weather is essential, the effect of rainfall is invariably positive, with a maximum coefficient for the period which is correlated with the earing stage.

(3) With regard to the daily range of temperature, it appears that in all the monthly periods succeeding sowing, the coefficient was negative between this and the yield, with a maximum coefficient, in the third period of 5 ½ times the probable error.

(4) With regard to the mean daily minimum temperature: (1) The effect of this factor in the first and fourth periods after sowing is negligible; (2) the coefficient is negative, in the second and third periods, during which the temperature is lowered (compare with preceding values).

It can then be concluded that moisture and temperature are very important factors after sowing, but that in the first 60 days there is in Manitoba sufficient moisture and low enough range of temperature to prevent evaporation to a harmful extent.

With reference to temperature and rainfall, the coefficient became, on the contrary, constant and higher in the third 30 days after the sowing period. This is the critical period in Manitoba. If the cool and moist conditions continue, the yield will prove heavy ; if on the other hand it is warm and dry, the harvest will be light.

Taking the average date of sowing as April 25, the average time of the critical period may be fixed as the last week in June, and the first three weeks in July.

837 – **Climates of the British Empire Suitable for the Cultivation of Cotton.** — Brooks, C. E. P., in *The Meteorological Magazin*, Vol. LV, No. 651, pp. 37-39. London, April 1920.

Cotton is a sub-tropical plant which probably originated in the Eastern Mediterranean, but has become so throughly naturalised in the Southern States of America (" Cotton belt ") that they must be considered as having the most suitable climate for the commercial cultivation of this plant.

The cotton belt includes the States of Tennessee, Alabama, South Carolina, Louisiana, Texas and Oklahoma.

The essential features of a cotton growing climate are:

1) The mean annual temperature not below 60° F.

2) The mean temperature of the warmest month exceeding 80° F, or the mean of the three warmest months exceeding 77° F.

3) The interval without frost at least 200 days or more.

4) The annual rainfall not exceeding 60 in. and not less than 23 in.

5) Plenty of bright sunshine.

A dull and humid atmosphere is very unfavourable to growth of the cotton plant.

In the Cotton belt of the United States the rainfall lies between 23 and 60 in ; the mean annual temperature nowhere falls below 60° F, and the warmest month always just exceeds 80° F.

In the British Empire these conditions are met with in parts of India and in the West Indies, which are already important cotton producing centres.

Other colonies included in the same category are also here dealt with

Uganda. — Represented by Entebbe lies at an elevation of more than 3 000 ft. which effects obviously the equatorial temperature ; the temperature is rather below the specified temperature for the warmest month, but the uniformity both in temperature and rainfall throughout the year should enable cotton crops to be grown with some success.

Nyasaland. — Represented by Zomba at a height of 3 000 ft. The annal rainfall is 55 in. with a well-marked dry season. The summer temperature is nearly 75° F and cotton growing has already been tried with some success. On the lower ground near Lake Tanganyika and the Shire River it should do very well, and only lack of transport is against successful commercial cotton production.

Gambia. — Cotton should do well as an irrigated crop in the dry season. Bathhurst has a very suitable climate for the development of this plant, except for the length of the dry season, and the excessive rain in August.

Soudan. — Represented by Wan, has a very favourable climate for cotton ; in the drier parts, irrigation would, however, be necessary.

Nigeria. — The coastal regions of Nigeria (Lagos) appear to be too moist and rainy ; but, further inland, on the contrary (Zungern), conditions appear to be excellent.

Gold Coast. — The rainfall is very variable, but less than that of the Nigerian coast, and cotton should do well.

Rhodesia. — Similar climate to that of Zomba, and cotton should do well in the low lying parts of the colony.

British east Africa. — Consists of a low coastal region (Zanzibar) and the Kenia plateau (Nairobi). The plateau is too high with too low a temperature and in the coastal belt the rainfall is generally too heavy for cotton cultivation on a large scale.

Union of South Africa. — Hardly warm enough, sparse and irregular rainfall. Cultivation is only possible on the east coast, and in Natal.

Australia. — The Northern Territory is too wet, and the coast of Queensland seems more suitable. Further south, in New South Wales

and Victoria, cotton has been tried but with scarcely any success commercially.

In Western Australia, Egyptian cotton should be a success in the wetter districts but without irrigation the interior is too arid.

NEW GUINEA. — Probably a future source of supply. On the southern coast, the climate is very suitable, where a native cotton of good quality already exists.

The colonies such as Sierra Leone, Borneo, Fiji, Seychelles, British Honduras, Ceylon, Straits Settlements and British Guiana are in general too damp for the production of special quality cotton, whilst in Cyprus and Malta the rainfall is too sparse and irregular.

838 – **Effects of Drought in the Spring of 1919 on the Tea Districts in India.** – *The Tropical Agriculturist*, Vol. LIII, No. 5, pp. 305-308. Peradeniya, Ceylon, Nov. 1919.

In the first week of April 1919, towards the close of the drought from which the tea districts suffered, the following observations were made at the Experiment Station :

1) Unpruned tea showed very distinct signs of suffering and lost leaves in great quantity.

2) Pruned tea, on the other hand, was growing normally although the leaves produced were very small.

3) The water content of the soil at 9 in., deep was about 12 % water, while the subsoil at 3 ft. contained about 15 %. It cannot therefore be said that water was seriously deficient, but what factors influenced the obviously bad condition of the plantations left impruned, and the small size of the leaves of the pruned plants ?

During the period under consideration and especially during the first week of April, the atmosphere was both hot and dry ; conditions very favourable to transpiration. The unpruned tea possessed a leaf area with a rate of transpiration so rapid in relation to the water supply in the soil that the balance was upset, and the plants suffered by dropping leaves because unable to maintain the existing leaf area. On the other hand, with pruned bushes, the leaf area during the drought having been somewhat reduced, the transpiration was limited. In either case, the plants were subject to the same effect, namely the reduction of leaf area.

Certain suggestions are made with regard to effective conservation of moisture in the soil, to assist capilliary rise, and to encourage the growth of deep rooted plants.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

839 – **Effect of Variation in Moisture Content on the Water Extracts of Soils.** — MARTIN, J. C. and CHRISTIE, A. W. (Division of Agricultural Chemistry, California Agricultural Experiment Station, in *Journal of Agricultural Research*, Vol. XVIII, No. 3, pp. 139-143. Washington, D. C., Nov. 1, 1919.

A knowledge of the effect produced on the water-soluble matter by variations in the moisture content of the soil is an important feature in connection with investigations of the water extracts of soils.

Two typical soils in the air-dry condition were studied: (1) silty clay loam; and (2) sandy loam. No. 1 was brought to a moisture content of 10 to 25 % and No. 2, 5 to 20 %.

The moisture contents approaching the air-dry condition show a decided tendency to depress the nitrates and potassium in both soils, and the sulphates in the silty clay loam only. These depressions are reflected in the total dissolved material.

The excess water in the sandy loam soil causes a disappearance of nitrates and also decidedly decreases the potassium, calcium and magnesium, these losses also being reflected in the total solids extracted.

Considerable variations in moisture content of soils, provided the saturation point is not reached, do not appreciably modify the results obtained by the water-extraction method, and consequently it may be concluded that the study of these extracts need not necessarily be limited to a narrow range moisture content.

840 – **Effect of Calcium Sulphate on the Solubility of Soils.** — Mc Cool, M. M. (Professor of Soils) and Millar, C. E. (Associate Professor of Soils, Michigan Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. XIX, No. 2, pp. 47-54, tables 8, Washington, D. C., April 15, 1920.

Additional information on the rate of formation of soluble salts in soils as affected by different factors is yet required, including one phase of the subject of special interest, namely, the immediate and residuary effects of fertilising materials.

Because of the experiences of the early agriculturists and the increasing interest in the fertilising value of calcium sulphate, and the widespread use of superphosphate which contains appreciable amounts of sulphate, the authors considered it advisable to investigate the effect of the calcium sulphate both alone, and in conjunction with calcium phosphate, on the formation of soluble salts in soils, as well as the effect on calcium dioxide production. The freezing point method was used to determine the former, and the titration method the latter. Six types of soil were studied: silt loam, sand, sandy loam, very fine sand, heavy silt loam, and silt loam.

The treatment with saturated solution of calcium sulphate caused a considerable increase in the rate of formation of soluble salts; the same results were obtained a second time, and it is obvious that this treatment results in such changes in the composition of the soil mass, that a soil of different properties is formed. It seems therefore possible to alter the composition of the soil solution; whether the effect will be favourable or unfavourable with regard to plant growth will depend upon the nature of the soil, and of substances added. Here is a phase of the subject which has not received sufficient attention in connection with field experiments.

Whilst the calcium sulphate increased the solubility of the various soils under investigation, the calcium phosphate decreased the rate of formation, and when used in conjunction with the former, it counteracted the effect of the latter to some extent.

The determination of the calcium dioxide, taken as a measurement of the biological activities does not always coincide with the total quantity of soluble substances formed ; the increase in the rate of formation of these substances brought about by the calcium sulphate treatment, should therefore be attributed mainly to other causes.

MANURES AND MANURING

841 – **Carbonates of Calcium and Magnesium in Relation to the Chemical Composition, Bacterial Contents and Productivity of Two Very Acid Soils.** — CONNER, S. D. (Associate Chemist in Soils and Crops), and NOYES, H. F. (Research Associate in Horticultural Chemistry and Bacteriology, Purdue University Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. XVIII, No. 3, pp. 119-125, pl. 2, bibliogr. of 8 works. Washington, D. C., Nov. 1, 1919.

Agricultural limestones so frequently contain large quantities of magnesium, that the question of the relative values of calcium and magnesium carbonates as neutralisers of soil acidity is of great practical importance. Many instances where magnesium has had detrimental effects have been reported.

In order to throw light on this question, the authors conducted pot tests on very acid soils of distinctly different types : silty clay ; and sandy peat, using natural carbonates, calcite, dolomite and magnesite, in varying amounts (4000 lb. to 12 000 lb. per million lb. soil), wheat, red clover, and turnip beets were grown in succession. After 10 months cropping under optimum moisture conditions, the soils were analysed for salts, nitrates, carbon, dioxide, acidity, nitrification, and both aerobic and anaerobic bacteria.

Although both soils originally contained twice as much magnesium oxide as calcium oxide, the calcite, dolomite, and magnesite produced good crop increases on both soils, with one exception, namely the 6-ton application of magnesite on the black sandy peat, which killed the crops. The best crop increase were obtained with carbonate applications which produced ratios of calcium oxide to magnesium oxide varying from 2 : 1 to 1 : 5.3 on the clay soil, and from 3.4 : 1 to 1 : 4 on the sandy soil. In the case which caused crop failure the ratio was 1 : 7.9 Wheat, red clover, and beets responded differently toward calcium and magnesium carbonates. With the medium applications, beets, were benefited more by magnesium carbonate, while wheat and clover gave a higher increase in yield with calcium than with magnesium carbonate.

Magnesite in every case, increased the concentrations of soluble salts in the soils more than calcite. Carbon dioxide determinations showed that the carbonates were not entirely decomposed at the end of one year, although the decomposition of the magnesite seems to have proceeded faster than that of the calcite. The magnesite produced more favourable conditions for nitrification than calcite. Magnesite thus encouraged the more rapid multiplication of both aerobic and anaerobic bacteria on the clay soil, more than the calcite, but on the sandy soil the reverse was evident.

The injurious action of the high magnesite application on the sandy soil is difficult to determine, as there appears to be insufficient data

to hand to ascertain if it is due to an unfavourable calcium magnesium ratio, or to a high concentration of soluble magnesium salts ; nevertheless, in view of the fact that the sandy peat still gave an acid reaction after the heaviest magnesite application, it is evident that the crop injury was not due to alkalinity. Moreover, the crop results do not point to any particular ratio between calcium and magnesium which could be called optimum for either crop or soil.

842 – **"Wool Waste" as a Fertiliser.** — SCHRIBAUX in *Comptes rendus de l'Académie d'agriculture de France*, vol. VI, No. 20, pp. 509-510. Paris, May 26, 1920.

The author communicates a statement by Dr. A. DE ROTSCHILD, dealing with the disadvantages entailed by the use of wool waste as a fertiliser. This substance is very cheap, it is true, but through its application, the soil may be contaminated with the seeds of two weeds, Spotted Lucerne (*Medicago maculata*) and Toothed Lucerne (*M. denticulata*) which are present in considerable numbers in the refuse.

M. SCHRIBAUX, Director of the Seed Testing Station, on being consulted by Dr. DE ROTSCHILD, stated that a sample of wool refuse treated with sulphuric acid, proved to contain 3.8 % of the seeds of these two varieties of lucerne. He also said, that 60 % of such seeds germinated, and that there were present, in addition, 20 % of hard seeds, viz., seeds which are inert owing to the impermeability of their integument, and which may germinate after an indeterminate time.

CONCLUSION : every metric ton of fertiliser contains therefore 38 kg. of seeds of which 38 × 60 : 100 = 22.8 kg. will germinate immediately These would cover the ground to the same extent as a crop of lucerne intentionally sown. Further, there will also remain in the soil hard seeds which may produce new plants of *Medicago maculata* for several years.

843 – **The Fertilising Value of Sewage Sludge.** — BRENCHLEY, W. E. and RICHARDS, E. H. (Rothamsted Experiment Station), in *Journal of the Society of Chemical Industry*, Vol. 39, No. 13, pp. 177-182. figs. 3. London, July 15, 1920.

The sewage sludges produced by the usual methods of tank treatment have never been highly valued as manure. Recently, two new methods of sewage have been introduced, viz. slate beds and activated sludge. Both these processes have been proved by the authors, to yield sludges which possess a definite manurial value.

An analysis of 3 samples from precipitation tanks gave the following results :

	Activated %	Slate %	Precipitation %
Moisture	7.26	55.65	37.67
Organic matter	76.72	20.76	24.81
Inorganic » (grit)	16.02	23.59	37.52
Nitrogen. — Calculated on sludges dried at 100°C.	7.09	2.63	0.89
Phosphoric acid	3.82	0.34	0.66
Potash	1.12	0.08	0.07

Pot experiments were carried out with poor soil first with barley, second with mustard, and comparisons were made between the results with sodium nitrate and the control. The results relative to the dry matter were as follows.

	% increase over control	
	I Barley	II Mustard
Sodium nitrate	51.12	473.4
Activated sludge	64.77	105.3
Ditto (6 equivalents)	91.74	939.7
Slate bed sludge (1/2 equivalent)	21.75	16.1
Ditto (1 equivalent)	31.80	79.0

It is evident that the activated sludge has a very real manurial value by reason of its relatively high content of available nitrogen as shown by the nitrification experiments compared with dried blood, the manures being added at the rate of 60 parts of nitrogen to 1 000 000 of soil.

	Nitrates: Parts per million of dry soil			
	At start	After 32 days	After 106 days	After 200 days
Soil only	7.3	10.7	17.5	16.8
Soil + slate bed sludge	7.3	18.0	33.1	33.2
Soil + activated sludge	7.3	32.3	56.0	60.9
Soil + dried blood	7.3	34.0	77.6	75.2

While in the second crop it is clear that dressings of slate bed and activated sludges had a certain residual value, it was not so marked as with sodium nitrate. According to the second table, however, the heavy dressing of activated sludge more than doubled the residual manurial value obtained with sodium nitrate.

The practical difficulty of drying the sludge containing 98 % of water as it comes from the settling tanks, has yet to be overcome, but activated sludge promises to become a valuable manure for the farmer and market gardener.

With regard to the slate sludge, this also has a definite manurial value. The process of sewage purification is hardly yet out of the experimental stage, and there are comparatively few sewage works of any size where slate beds are in use.

844 – **New Types of Basic Slag for Sale in the British Isles.** — The Rothamsted Experiment Station in *The Journal of the Board of Agriculture*, Vol. XXVI, No. 8, pp. 829-830. London, 1919.

There are distinct types of basic slag on sale in the British Isles which must on no account be confused.

1. BESSEMER slag, containing phosphoric acid equivalent to 40 % or more of tricalcic phosphate, largely soluble in 2 % citric acid: usually 80 % of the total is guaranteed soluble.

2. Basic "open hearth," containing less phosphoric acid, equivalent to 15 to 31 % of tricalcic phosphate, largely soluble (80 %) in a 2 % citric acid, the first pourings being richer than the last.

3. *Idem*, made by the use of lime and fluorspar, containing as much phosphate as the poor grades of the preceding class, but only slightly soluble (20 % or less) in 2 % citric acid.

The first of these 3 types, the Bessemer slag is the fertiliser which for many years was well known to farmers as one of the most effective fertilisers for pasture land. The second and third types have come into prominence in recent years, especially during the war, as a result of changes in the method of making steel. At first sight these two new types do not appear very promising agriculturally, but field experiments have shown that they possess distinct value. Experiments conducted in 4 counties by 4 different experimentors demonstrated that the second type has proved substantially equal in fertiliser value to the old BESSEMER slags, when compared on equal phosphate content. The 3rd type proved more effective than was at first assumed from their low solubility in citric acid (2 %). When the growing season has been sufficiently long, these slags have proved approximately as useful as the others, in spite of their low solubility.

With reference to the question as to whether the poor slags are worth as high a price as the rich, although it cannot be denied that the value of slag lies in other constituents apart from phosphates, it is safest however in accordance with present knowledge to adopt the plan of judging the new slags on their phosphatic content, that is to say, according to the unit system, and the degree of fineness. Having allowed for this, there is probably no justification for paying more for the 40% slag than for the others.

845 – **The Retrogradation of Superphosphates.** — AITA, A. in *Giornale di Chimica Industriale ed Applicata*, Year II, No. 5, pp. 227-233, Figs. 2. Milan, May, 1920.

The author gives an account of a series of experiments made at different dates and on several occasions upon certain superphosphates derived from different types of phosphorite. Samples in perfect condition and containing ferrous sulphate or ferric sulphate in different proportions, were kept for a long time at the temperature of the surrounding air, enclosed in bottles with ground-in stoppers. As soon as the mixtures were made, the following substances were estimated : Total phosphoric acid (solution in dilute aqua regia), phosphoric acid soluble in water and ammonium citrate, and that soluble in water according to the official method ; free phosphoric acid extracted by means of anhydrous ether ; compounds of iron and aluminum as oxides (total and water soluble). The progress of the process of retrogadation in the compounds was followed by means of analyses carried out over a whole year at fixed intervals. The following were determined : phosphoric acid soluble in water, in ammonium citrate, and in water alone, according to the official method ; free phosphoric acid, determined by extraction with anhydrous ether (the solvent being afterwards evaporated off), followed by precipitation with magnesia mixture ; iron and aluminium compounds (estimated as oxides) soluble in water. From the difference between the amounts thus

obtained and those found in the mixture directly they were made, the amount of the retrograded phosphoric acid was determined in the citric solution, and the aqueous solution, respectively (relative percentages), as well as the absolute retrogradation percentages, namely, those relating to the amounts found in each product from the time the mixture was made. The latter figures show the progress of the process more plainly.

From the results obtained, it would appear that the retrogradation of the superphosphates must not be attributed to physical causes, but wholly to chemical causes, and that it is the expression of the state of equilibrium which, in the course of time, is established between certain constituents of the product compounds of iron and aluminium, free, phosphoric acid, and monocalcic phosphate — as regards the amount of them present, and the relations existing between them. This way of looking at the matter thoroughly explains what has actually been observed as regards both the normal, and anomalous behaviour of the different superphosphates.

In fact, no retrogradation is observed in superphosphates from phosphorites from North Africa, even after having been stored for many months. In these phosphates, the content of oxides of iron and aluminium never exceeds 2 % and sometimes is below 1%. For this reason, the superphospates made from them will contain from about 0.50 to 1 % of the said oxides, as against from 1 to 2 % of free phosphoric acid if they are prepared scientifically, that is to say, the proportion between the free phosphoric acid and the oxides is as 2 is to 1 — the lowest proportion permitting of the establishment of a definitive state of equilibrium. On the other hand, retrogradation is sometimes, but not always, found in superphospates made from the phosphorites of America and the Pacific Islands, which have an oxide content of from 2.5 to 3 %, and even more. It is evident that these superphosphates will, or will not be liable to retrogradation according as to whether, or not, the above-mentioned proportion between free phosphoric acid and the oxides exists.

In the technique of the manufacture of superphosphates, it is therefore of paramount importance to known the exact amount of iron and aluminium compounds in the phosphates to be transformed, in order to treat them in such a manner as to obtain a product with the right proportion between the free phosphoric acid and the oxides, and thus prevent retrogradation This requires every precaution, and care must be taken not to go beyond certain limits, otherwise the product is lumpy, damp, and doughy; these physico-mechanical characters are due to the proportions of water and of free acid taken as a whole.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

846 – **Physiological Pre-determination: The Effect of Conditions during Germination, and in the Early Seedling Stage Upon Subsequent Growth and Final Yield.** – KIDD F., and WEST. C. in *The Journal of Applied Biology*, Vol. VI, No.1, pp. 1-26, figs: 3, pl. 1, Bibliography of 44 works. Cambridge, September 1910.

Evidence as a whole seems to show that the factors which influence the plant during its earliest stages of development, have a more or less pronounced effect upon the whole of its subsequent life history.

The authors undertook to study the predeterminating influence, and the present paper is a continuation of, preceding work (1) in connection with the effect of the conditions during germination and in the early seedling stage upon subsequent growth and final yield

Seed treatments were classified as follows:

I. *Physical treatments.* — Experimental work was carried out with seeds submitted to high and low temperatures, electrical discharge, and X. rays.

The chief point of importance notified was the fact that the effect of exposure to low temperatures was a very clear and distinct phenomenon. This confirms GASSNER'S investigations which had already showu that it was during the first few hours of germination that the " pre-determination phenomenon " can be most easily and quickly brought about by exposure to cold

II. *Chemical treatments.* (2) Experiments were made with seed soaked in various acid solutions ; and other chemical agents such as copper sulphate, other salts; and hydrogen peroxide. Very little experimental work is on record with regard to the subsequent growth and yield of the plants produced from the treated seeds, but all available evidence supports the conclusion that where germination and early seedling growth are stimulated by chemical treatments, the subsequent growth and final yield are favourably influenced in proportion.

Normal plant-growth therefore falls into line with a « compound interest " law of development. Data obtained from growth experiments from plants or seeds deprived of part of their original food reserve, show that broadly speaking, the growth and yield of the resulting plants are proportional to their initial " food capital. "

847 - **Experiment made with " Clumine " upon Wheat, Barley and Oats in the Experiment Field of Grotta Rossa (Rome).** — CUSUHANO, E., in *L'Italia agricola*, Year 57, No. 6, pp. 178-180. Piacenza, June 15, 1920.

Prof. LO MONACO, Director of the Institute of Physiological Chemistry of the Royal University of Rome, observed while studying certain asphyxiating gases, that they possessed the property of accelerating the germination of seed. He found, on growing various plants in nutritive solutions, that in the presence of these gases they germinated better, grew more vigorously, and gave a larger yield. He also obtained excellent results with Leguminosae and Gramineae cultivated in the open.

To this new fertiliser Prof. LO MONACO has given the name of " Clumine ", and the author has made comparative experiments for the purpose of testing, the effects of " clumine " and other fertilisers. In the above-mentioned article he gives the cultural data, the analyses of the soils before and after the experiments, the crops obtained from manured and unmanured soils, as well as soil analyses and data referring

(1) See *R.* June 1917, No. 533 ; August 1917, No 717; *R.* Sept. 1917 No. 804.

(2) On the influence of water treatment on cereal seeds, etc. See *R.*, Dec. 1918, No. 1341 ; *R.* Febr. 1919, No. 177; *R.* Oct.-Dec. 1919, No. 1113. (*Ed.*)

to the crops obtained in different parts of Italy in the course of other experiments with the same fertiliser.

In the experiments carried out by the author at Grotta Rossa (Rome) "clumine" induced more rapid germination, and earlier ripening, (the manured plots being 3 days ahead of the unmanured), and al arger yield of grain (the increase bring 850, 765 and 280 kg. per h ctare in the cases of oats, barley and wheat respectively). Of the three applications of the fertiliser (50, 100, and 150 kg. per hectare), the intermediate amount had the greatest effect. "Clumine" does not exaust the soil, except in so far as it leads to a larger crop. Experiments made in other parts of Italy confirm these results.

The author has the intention of continuing his investigations, but from what he has so far been able to see, he is of opinion that the action of "Clumine" is complex In fact, it acts upon the seed by hastening its germination; it enables cultivated plants to get the better of weeds; it has an effect upon the organic and mineral substances present in the soil, rendering than more easily assimilated by the plants; and it is probable that it has a partial sterilising action upon the soil.

848 – **The Time Required for Chlorophyll to Develop its Maximum Colour Intensity in the Presence of Light.** — COUPIN, H., in *Comptes rendus de l'Académie de Sciences*, Vol. CLXX, No. 12, pp. 753-754. Paris, March 22, 1920.

As the author has stated in a recent paper (1), seedlings grown with insufficient, or intermittent light are of a pale green colour, whereas those exposed for a sufficient length of time to the light are more or less dark green according to the species and the organs taken into account.

In view of the latter fact, the question arises as to the minimum time necessary for the maximum depth of colour to be attained, but data on this subject are very scanty. With the object of solving this problem, the author exposed to the light some young etiolated seedlings (grown in spring water), and noted the time when their green colour ceased to become more intense (the changes in tint were observed by means of a scale of colours or, in a more practical manner, by comparing the seedlings with others that had already been growing for some days in the light). In this way, the author obtained the appended figures giving the minimum time (in days) necessary for the chlorophyll plastids to become saturated with chlorophyll.

Leaves: Winter vetch 1, sugar maize 1, wheat (var *hybride des alliés* 2, nasturtium 2, lentil 2, bean 2, haricot bean 3, American bean 3, Michaux pea 4.

Cotyledons: Lucerne 1, tomato 1, radish 1, scorzia 1, spinach 1, chicory 2, buckwheat 2, carrot 2, pumpkin 2, marvel of Peru 3, dittander (*Lepidium latifolium* L.) 3, sunflower 4, haricot bean 4 (?), red castor plant 4 (?), American bean 4, white lupin 5.

Hypocotyl axes: Radish 3, sunflower 4, dittander 4, scorzia 4, pumpkin 4, white lupin 6, carrot 6, haricot bean 6, buckwheat 7, lucerne 8, marvel of Peru 10, tomato 14, chicory 15, spinach, red castor plant, and American bean did not become green.

Stalks: Nasturtium 4, bean 5, winter vetch 6, Michaux pea 7.

(1) See *R.*, April 1920, No. 400. (*Ed.*)

The above figures were obtained in Paris, during January and February (diffused light and northern exposure) ; during these months, the daylight is weak, and only lasts ten hours.

The figures only apply to plants grown under these conditions, but they give an idea of the extent of the question, and the manner in which different plants behave. No general conclusion can be drawn from the experiments, but the following remarks, which might *a priori* have been expected, have been elucidated, and are worth recording :

(1) The green colour of cotyledons and leaves does not take very long (1-5 days) to reach its maximum intensity.

(2) Hypocotyl axes and stalks take a rather long time (3-15 days) to assume their maximum colour.

(3) The green colour of the different organs of the same plant does not reach its maximum intensity in the some time

(4) In some cases, this maximum colouration is not reached (under the existing conditions during the experiment) before ten hours' exposure to light.

849 – **Carbohydrate Metabolism in Green Sweet Maize During Storage at Different Temperatures.** — APPLEMAN, C. O. and ARTHUR, J. M. in *The Journal of Agricultural Research*, Vol. XVII, No. 4, pp. 137-152, figs. 2, tables 5. Washington, D. C., July 15, 1919.

Report of work carried on at the Maryland Agricultural Experiment Station with a view to studying the character and kinetics of the processes involved in the rapid depletion of sugar in green sweet maize after it is separated from the stalk and more particularly with the relative rates of these processes at different storage temperatures, accurately controlled.

The authors devised a method by which the rate of sugar loss from the green sweet maize could be determined for consecutive 24 hour periods of storage, by comparing analyses of grain from the same ear. The Stowell Evergreen variety was used for these investigations; this was picked in the typical milk stage (water content approximately 80 %), that is to say, the best edible stage.

The depletion of sugar in green sweet maize after it is separated from the stalk does not proceed at a uniform rate, but becomes slower and slower, until finally it ceases, when the initial total sugar has decreased about 62 % and the sucrose about 70 %. Calculated on the basis of original moisture, the maize contained when the depletion of sugar ceased, approximately 1.5 % total sugar as inverted sugar, 0.7 % sucrose, and 0.8 % free reducing substances. The reversibility of the chief processes involved in the sugar depletion, resulting in an equilibrium between the rate of sugar loss, and the rate of sugar formation, would account for the cessation of actual sugar loss.

The raising of the temperature hastens the attainment of the equilibrium positions, which seem to be about the same for all temperatures. At 30° C, 50% or most of the total sugar loss occurs during the first 24 hours of storage. During the same period 25 % is depleted at 20° C, and at 10° C, (a refrigerator temperature,) only about 15 % is depleted.

The rate of the sugar loss, until it reaches 50 % of the initial total sugar and 60 % of the sucrose, is doubled for every increase of 10° C up to 30° C.

Respiration in green maize is comparatively high when the maize is first picked, but falls off rapidly with prolonged storage. This, however, only accounts for a small part off the actual decrease in the percentage of sugar in the maize during the consecutive 24 hour periods of storage, even at 30° C. One ton of husked green sweet maize during the first 24 hours of storage at 30° C would lose approximately 3.2 lb. of sugar on account of respiration. Respiration may become indirectly a more important factor in accelerating the depletion of sugar by raising the temperature on the inside of the large stacks of green maize.

Most of the decrease in the percentage of sugar in green sweet maize is attributed by the authors to condensation of polysaccharides, chiefly starch.

850 – **Researches on the Ripening of Cereals.** LUERS, H. (Mitteilung aus der deutschen Forschungsanstalt für Lebensmittelchemie in München), in *Biochemische zeitschrift*, Vol. CIV, Parts. 1, 2, 3, pp. 30-81, figs. 1. Berlin, 1920.

Our knowledge of the processes taking place during the ripening of cereals is very limited. The experiments hitherto effected have either been made for the purpose of studying the vegetative development or the complete maturity of the plants, or else were carried out by incomplete and defective methods. The sole exceptions were the researches of SCHIERING and of SCHULZE, who studied the nitrogenous substances present during the ripening period.

The author has attempted to follow, by means of analyses, the variations in acidity and amido-nitrogen content observable from the first yellowing of the ears, till their complete maturity as well as during storage. He chose these two methods of determination, as similar analytical methods had been used with success in other fields of investigation.

In determining the amido-nitrogen, the author followed, with some slight modifications, SORENSEN'S formol method. When estimating the acidity he adopted SORENSEN'S colorimetric method, titrating the acid during the same experiment with two different indicators (neutral red and phenolphtalein). The author thus determined the amido-nitrogen and acid content of different samples of barley, wheat, oats and rye, from the last stage of the yellowing of the ears, until complete maturity, and also after two months' storage. He found that the acidity and the substances that could be titrated with formol greatly decrease during the period between the last stage of the yellowing of the grain and its complete maturity and diminish less after the grain is stored. This diminution was more marked in samples furthest from a condition of equilibrium, that is to say, from germination-maturity. The reason of the decrease in both these classes of substances is to be sought in the fact that the acids combine organically, whilst the amido compounds condense to higher complexes. It may also be deduced from these results that during the ripening and storing of grain, many changes take place in the enzymatic conditions.

Other experiments have shown that desiccation promotes the maturation of cereals, not on account of the loss of water, but owing to the stimulating effect heat, which is connected with the kinesis of intraseminal reactions.

The above mentioned experiments were made on samples of crops from a normal year, 1918; further investigations will be necessary for years that are meteorologically abnormal. From what has already been observed, it is possible to make some deductions, however, even as regards abnormal years, such as, for instance, 1904 and 1911, when the green barleys, by their incomplete ripening caused much trouble in Germany in the manufacture of malt and beer. The data already obtained would seem to show that the premature drying of the grain arrests the processes of transformation, and the building up of more complex molecules. The immature condition of the grain is shown by the presence of considerable numbers of simpler molecular structures belonging to pre-existing substances. These abnormal conditions also influence other factors; thus there is no doubt that the bread-making qualities of a flour depend, to a great extent, upon the ripeness of the wheat.

PLANT BREEDING

851 - **Wheat Varieties from the Rieti "Stazione di Granicoltura" The "Varrone Variety"** — STRAMPELLI, N., in *Italia Agricola*, Year 57, No. 5, pp. 146, pl. 1. Piacenza, May 15, 1920.

This is the type known as No. 92,000 202 4413; it belongs to the numerous types obtained by the cross Rieti × Wilhelmina Tarwe.

Ear: is white, its average density is 23. The number of fertile spikelets varies from a minimum of 21 to a maximum of 25 (average 23 per ear).

Spikelets: from 3 to 4 fertile flowers, and the number of caryopses varies from 52 (minimum) to 85 (maximum). The average per ear is 65.

Glumes: oval, inflated, slightly truncated; very short triangular beak bearing at its base 2 short, light reddish-yellow ribs similar to the median rib.

Paleae: oval, surmounted by short, scarcely perceptible awns (1-2 mm) on the lower portion of the ear, but becoming larger (3 to 15 mm.) on the upper part. They are more marked on one side of the ear than on the other; the most marked ones grow in the direction of the axis of the paleae.

Seed: oval, slightly convex and asymmetrical, with broad, very open ventral suture; lobes triangular in section. They have a characteristic long furrow on the back. Average length 7 mm., width 3-7 mm., dorso-ventral maximum 3 06 mm. Colour yellowish-white. Fracture starchy. weight of 1000 seeds 53.43 gm.

The *culms* are from 1.40 to 1.50 m. in height, but they do not lodge.

Tillering good.

The "Varrone" variety *ripens* rather late — at the same time as "Carlotta Strampelli", but in good years, it is capable of producing a still larger crop than the latter. In 1918, the yield of "Varrone" wheat was as much as 46.2 quintals per hectare.

852 - **Improvement of Native Wheat Varieties by Means of Selection, in Bulgaria.** — IVANOV Iv., in *Zemlediclie*, Year XXIV, Pts 4-5, pp. 66-72, Sofia, April, 1920.

The improvement of cultivated plants by means of selection and hybridisation has contributed greatly to increase the yield, especially in the case of cereals.

The Table given below shows the average data for the period 1907-1912 in Svalöf (Southern Sweden), concerning wheat only.

The new varieties give a yield, at the rate of 20 to 40 % higher than the native varieties.

From a series of comparative cultural experiments with new and old varieties of wheat, rye, barley and oats, conducted under the control of the German Agricultural Society, data have been obtained which prove the part played by selection in the increase of crop yield. Table II shows the average yield in kg. per hectare for the various crops.

	Yield of grain kg. per hectare	Relative % of prodnctivity with deference to *native Swedish*
No. 0801	4 577	140
Sol	4 334	133
Extra Squarehead II	4 318	129
Grenadier II.	3 958	121
Native Swedish	3 221	100

	Wheat	Rye	Barley	Oats
New varieties	3 130	2 280	2 670	2 770
Old »	2 550	1 910	2 260	2 550
Variation in yield	580	370	410	280

The surplus yield obtained, thanks to the adoption of new varieties and types, is thus raised by a minimum of 280 kg. for oats and 580 kg. for wheat.

With regard to Bulgaria, little has been done up to the present. The introduction of selected exotic types has not so far given good results with the exception of the " Noé " wheat variety, which was inferior to the native varieties during the two somewhat trying seasons of 1917 and 1918. The German wheats of the Squarehead type and, usually, the types coming from the north or from maritime regions do not readily adapt themselves to the special climatic or other conditions prevalent in Bulgaria owing to the length of the vegetative period. The late types which at the end of June and the beginning of July are still at the milk stage, suffer from scorching and produce a low yield of inferior quality.

This points to the conclusion that only new varieties can safely be introduced, which originated in countries with a climate similar to that of Bu garia, if good results are to be expected. Therefore, local selection and breeding is obviously most suitable, especially in Bulgaria, where the local varieties are far from being pure and possess the characteristics of a mixed population consisting of a collection of different individual characteristics. In such cases simple, pure line selection, by means of isolation and propagation of the best varieties, will lead to excellent results. Work of this kind was begun at Rusa, at the Agricultural Experiment Station, in 1911, special attention being paid to the local wheat and the Rasgrad wheat.

The results so far obtained are very satisfactory, as may be seen from the following Table :

	Surplus yield obtained from the original non-selected variety	
	kg. per hectare	%
Local selected wheat var. No. 13.	200	20
» » » » No. 11.	230	21
» » » » No. 83 (white ears)	35	22
» » » » No. 16.	68	48

The surplus yield is thus 200 to 680 kg. per hectare (20 to 48 %).

The cultural tests conducted at the Station in 1919 on a sufficiently large area and under the most uniform cultural agro-geological and topographical conditions, etc., possible, confirm the superiority of the selected types. In the Table, the data take also into account the resistance to rust and lodging, following an empirical scale of value 1-4 (1 = very resistant ; 2 = good ; 3 = fair ; 4 = poor).

	Yield of grain per hectare kg.	Weight per hl. kg.	Weight of 100 grains + gr.	Degree of Resistance to lodging	Degree of Resistance to rust
1. No. 84 (with white ear *selected*)	3 630	79.9	39.6	1	1–2
2. No. 83 (d.°)	3 400	79.7	34.2	1	3
3. No. 16 (with red ear *selected*)	3 320	79.2	40.3	1–2	2
4. No. 14 (d.°)	3 170	80.5	—	4	3–4
5. No. 1 (d.°)	3 070	79.1	—	4	3
6. No. 7 (d.°)	3 010	80.6	45.5	1	3
7. Red de Rasgrad (non selected)	2 620	79.3	37.8	4	4
8. Local var. (non selected)	2 470	79.4	38.7	4	4

The highest yield obtained was given by No. 84, with 3630 kg. per hectare : followed by Nos. 83, 16, 14, 1 and 7, Rasgrad wheat, and the

last on the list was the native non-selected variety, which gave only 2470. The Table given below brings out the comparison even more clearly.

	Surplus. Kg. of grain per hectare		Relative productivity	
	Rasgrad	Local var.	Rasgrad = 100	Local var. = 100
No. 84	1 010	1 070	138	147
No. 83	770	930	129	138
No. 16	770	850	127	134
No. 14	550	700	121	128
No. 1	450	600	117	126
No. 7	390	540	115	122
Average	640	800	124	132

The superiority of the new varieties obtained by selection is therefore obvious, as much by the yield as by other characteristics such as weight and size, resistance to rust and lodging.

For the various varieties considered individually the following may be taken as the most outstanding characteristics:

No. 84: white ear awned; derived from an ear gathered at Kinseleri, in the Dobrié district.

No. 83: white ear.

No. 16: red ear, awned; originated at Azienez, near Rasgrad.

No. 14: coloured ear, awned.

No. 1: coloured ear, awned.

No. 7: coloured ear awned; characterised by resistance to lodging.

The results obtained encourage future prospects and the possibility of extending and intensifying the work of selection.

The Bulgarian Agricultural Society, in the same way as the Society of German Farmers, should be able to collaborate for the purpose of distributing good quality seed, by establishing more experimental plots in the various districts, with a view to the discovery of the newly introduced varieties that are the best adapted to the local conditions of soils and climate.

853 · **Selection of Rice Varieties at the Rice-growing Station at Cantho, Cochin-China.** — ROBIN, J., in *the Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 6, pp. 185-189. Saïgon, June 1920.

The method of selection so far adopted at the "Station Rizicole de Cantho" (connected with the Genetics Laboratory of the Scientific Institute of Indo China), resembles very largely that employed by VILMORIN to obtain select lines rather than the Buitenzorg methods.

A choice was first made of the 100 best plants of the variety that was to be selected. These were classified according to the number of ears and then the grains were weighed seperately for each plant.

The 10 at the head of the list, viz., those weighing the heaviest and having the largest number of ears, were sown separately; the plants pricked out one by one at 6.8×6.8 produced the second generation.

Each line was classified according to the number of ears and the 15 or 20 best of each line were weighed.

To avoid the multiplication of an indefinite number of lines which would necessitate unending labour and greatly increase the possibilities of error, owing to the impossibility of following them up closely, the investigations were limited to 10 per variety or lot.

The 10 plants chosen were selected indiscriminately from the 10 lines under consideration; the inferior quality lines were thus eliminated gradually, whilst the superior quality lines were more and more brought to the fore.

In spite of this elimination, there remained (in 1920) 16 varieties each consisting of 10 lots of 15 plants; i. e., $150 \times 10 \times 16 = 24\,000$ plants, whose ears must be counted, sorted, and shelled, whilst 3200 plants must be weighed in order to obtain the 160 parent plants for the year following.

The results thus obtained have been very encouraging

SELECTION OF THE PHUNG-TIEN VARIETY AT THE RICE-GROWING STATION AT CANTHO. — This rice, originating from Bentre, was received at Cantho in 1916 with the following information:

Variety	Phung-Tiên
Weight per hectolitre	57.14 kg.
Weight per 1000 grains	0.275 kg.
Percentage of red grain	3 %
Shape of grain	medium length
Colour	pale yellow
Growth period	157 days

After receipt of the seeds, these were sorted by hand, and blemished or undersized seed eliminated.

The first crop gave 80 l. of seed weighing 48.4 kg. viz., 60.5; kg. per hectolitre.

The seed was sown and the seedlings once more pricked out. One of these plots (No. XII) gave particularly successful results, and 150 fine plants were chosen therefrom and classified according to the number of ears; the 10 best were sown separately to be transplanted later for plant breeding purposes.

The 10 selected plants possessed the following characteristics:

	(1) 1	2	3	4	5	6	7	8	9	10
ears	32	29	29	28	29	25	26	26	25	25
weight of grain (in gm.)	136	130	127	113	110	110	108	105	95	90

(1) The numbers indicate the number of each generation. (*Ed.*)

Lines obtained (average).

	1	2	3	4	5	6	7	8	9	10
Ears	16.6	16.1	16.1	18.9	19.5	21.1	20.8	22.7	21.7	18.4
Grammes	68.0	63.1	56.1	63.1	57.5	67.6	75.0	87.0	75.1	71.1

The 10 best plants retained were:

Line	(9)	1	20	ears	118 grammes
»	(9)	2	27	»	118 »
»	(8)	3	37	»	109 »
»	(1)	5	30	»	103 »
»	(0)	6	20	»	100 »
»	(8)	7	24	»	99 »
»	(8)	8	20	»	94 »
»	(7)	9	28	»	92 »
»	(8)	0	20	»	92 »

This selection confirms previous results seeing that the highest average, No. 8, gave 4 plants; next comes No. 9 with 2 plants, and Nos. 1, 6, 7, and 10 with one plant only.

Nos. 2, 3, 4 and 5 pass directly to the lines. The descendants of this generation gave on an average:

	91	92	83	14	65	06	87	88	79	80
Ears	25.2	30	29.6	25.9	28	24.3	29.4	28.8	28.7	27.7
Grammes	105.6	101.9	97.4	91.8	9[illegible].8	101.2	120.2	100.3	109.9	103.3

Line 87, the best of the lot, gave 3 plants, and line 91, 2.

The 10 husks chosen were:

	791	922	873	874	875	916	147	068	609	910
Ears	42	52	35	30	29	28	27	27	35	2[illegible]
Grammes	206	162	162	154	140	138	138	135	134	12[illegible]

Their descendants gave on an average:

	791	922	873	874	875	916	147	068	659	910
Ears	26.3	25.5	27.2	27.3	27.8	25.4	27.9	28.4	29.9	25
Grammes	104.1	104	107	104.1	112.[illegible]	109.6	122.6	107.5	106	104.

The better lots, 147 and 865, each gave 2 female parents ; lots 791 and 922 were the only ones which gave nothing and passed on into the lines.

The ears chosen for 1920-1921 are :

	0681	9102	8753	1474	8735	8756	8747	9168	6599	1470
Ears	45	55	42	36	39	37	38	30	33	32
Grammes	260	258	246	232	220	204	182	180	172	170

The following table shows the improvement obtained.

	Lines average		Average Plants per 10 husks		Husk No. 1 for each generation		Husk No. 10 for each generation	
	Ears	Grammes	Ears	Grammes	Ears	Grammes	Ears	Grammes
1916–1917	—	—	25.4	103	32	136	25	90
1917–1918	19.19	68.36	27.4	112	20	118	20	92
1918–1919	28.76	102.24	32.7	149.8	42	206	22	129
1919–1920	26.66	108.69	38.7	212.4	45	200	32	170

Caretul examination of the descendants indicates the same ears sequence of progress :

1st generation . . .	No. 0	25 ears	90 grammes	No. 9	25 ears	95 grammes
2nd » . . .	No. 06	20 »	100 »	No. 91	20 »	118 »
3rd » . . .	No. 069	27 »	135 »	No. 910	22 »	129 »
4th » . . .	No. 0681	45 »	260 »	No. 9102	55 »	258 »

1st generation . . .	No. 8	25 ears	105 grammes	No. 1	32 ears	136 grammes
2nd » . . .	No. 87	24 »	99 »	No. 14	28 »	105 »
3rd » . . .	No. 875	29 »	140 »	No. 147	27 »	138 »
4th » . . .	No. 8753	42 »	246 »	No. 1474	36 »	232 »

These two last tables indicate a decrease after the first generation, and then a regular continuous increase.

Theoretical Yield. — The yields do not include all the crops obtained per hectare.

All the lines give (at the rate of 62 500 plants per hectare) :

Season 1917–1918 : — 0.06836 kg. × 62 500 = 4272.5 kg.
» 1919–1920 : — 0.10865 kg. × 62 500 = 679.625 kg.

and the best plant will give : — 0.260 kg. × 62 500 = 16 250 kg. — the 1917 crop produced only 2967 kg. from the best plot (No. XII).

It is essential that exceedingly favourable conditions prevail if a yield of 400 kg. per hectare be expected at the Rice-Growing Station at Cantho (1).

The theoretical yields tend to demonstrate the actual improvements.

Tillage. — Tillage depends on the improvement of the variety and also to a considerable extent on conditions more or less favourable to growth.

Number of ears per plant	1 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55
Number of plants:											
1st generation . . .	75	**410**	242	89	18	5	0	1	0	0	
2nd » . . .	16	270	**480**	397	191	62	11	5	0	1	1(52)
3rd » . . .	12	132	383	**408**	177	22	8	4	3	0	1(55)

On working out the biometric curves corresponding to the figures given in this Table, it will noticed that the position of the summit has moved from left to right.

854 – **Researches on the Genetic Composition of Certain Types of Peas.** — KAJANUS, B. and BERGS, S. O., in *Arkiv för Botanick*, Vol. XV, No. 10, pp 1-18, Stockholm, 1917.

An account of the results of a series of crosses made with the object of studying the genetic constitution of *Pisum*. In the crossing experiments, the 4 following types, which represent 4 pure lines, were used:

TYPE I. — Flowers white; stipules colourless; seeds of average size, perfectly smooth, seed-coat without pattern (retrogression of colour); hilum white; cotyledons yellow.

TYPE II. — Flowers light red; stipules red; seeds of average size, smooth; seed-coat light-brown, grey-green, light-green, without pattern; hilum brown; cotyledons yellow.

This type was obtained from a plant with red flowers and light brown seeds which appeared in 1913 at Weibullsholm, in a field of Danish peas (Suedinge).

TYPE III. — Flowers dark-red; stipules dark-red; seeds large and somewhat wrinkled; seed-coat dark-red to brown, without pattern; hilum black; cotyledons yellow.

TYPE IV. — Flowers dark-red; stipules dark-red; seeds of average size, almost smooth; seed-coat grey-green to light-brown with purple clots and dark-brown mottling; hilum black; cotyledons yellow.

(1) Concerning the yields obtained in the Far East compared with those obtained in Europe (especially in Italy). See No. 861 of this *Review*. (*Ed.*)

With these 4 types the following 5 crosses were made :

Type I ♀ × Type II ♂ ; Type I ♀ × Type III ♂ ; Type I ♀ × Type IV ♂ ; Type II ♀ × Type III ♂ ; Type III ♀ × Type IV ♂.

The following characters were taken into account : colour of flowers and stipules, ground colour and pattern of seed-coat, colour of hilum. These characters seem to depend upon 6 factors indicated by the letters **R, G, O, P, M,** and **S.**

R. — This factor, both in the homozygotic **RR** and in the heterozygotic **Rr**, determines the light-red colour of the flowers, the more or less light-brown colour of the seed-coat, and the brown colour of the hilum.

Plants of the constitution **rr** possess white flowers, white seedcoat, and in absence of **S**, also a white hilum.

G. — This factor when alone, has no perceptible influence, but when combined with **R**, it gives rise, both in the homozygotic and heterozygotic conditions, to dark-red flowers, a well marked grey-green seed coat sometimes with purple dottings, whereas the colour of the hilum remains unchanged ; **rr gg** seeds are, as a rule, indistinguish able from **rr GG** seeds.

O. — This is an inhibiting factor that, in the homozygous and heterozygous conditions alike, suppresses the brownish-red or dark-red of the seed-coat ; in **oo** seeds the cuticle is if this colour, but only when **R**, is also present ; in the absence of **G**, the hilum of **oo** seeds is blood-red.

P. — Both under homozygotic and heterozygotic conditions, this factor produces very distinct dark purple dottings. Very often this colouration extends to a large part of the cuticle, which sometimes may be entirely purple.

In **oo** seeds, the presence of **P** causes the purple part to assume a black hue, and become very clearly marked off. In **oo** seeds in which the purple colour is diffused, the colour appears uniformly black.

M. — Both in a homozygotic and in a heterozygotic condition, this factor causes dark-brown mottling of the seed-coat. When **P** and **M** are present at the same time, they produce brown patches and lines, purple eyes and dottings situated close together, and sometimes superposed.

In **oo** seeds with **M**, the mottling is very indistinct.

S. — Determines the black colour of the hilum.

By analysing the offspring of these crosses, the following genetic constitution is obtained for the 4 above mentioned types.

Type 1 — *r r* G G O O *p p m m s s*
» 2 — R R *g g* O O *p p m m s s*
» 3 — R R G G *o o p p m m* S S
» 4 — R R G G O O P P M M S S.

855 - On Groundnut Selection in French West Africa. — See No. 870 of this *Review*.

856 – **The Possibility of the Transmission of Certain Characters of *Papaver somniferum*** — KAJANUS BERGER, in *Arkiv för Botanik*, Vol. XV, No. 18, pp. 1-87, Parts I-III. Stockholm, 1919.

The author given the results of a series of investigations undertaken with a view to determining the genetic constitution of *Papaver somniferum*, especially as regards the following characters: Double and single flowers; petals entire or emarginate; colour of flowers; green striping of petals.

DOUBLE AND SINGLE FLOWERS. — As a rule, the single form is dominant in respect to the double. In only one case out of 27 crosses was the opposite observed in the F_2 of simple × double flowers, which numbered 104 individuals, including 72 double, and 32 simple according to the Mendelian ratio, 3 : 1

The author suggests the following scheme:

P: E E single × *e e* very full
F_1: E *e* from single to fairly full
F_2: 3 single-nearly full: 1 very full.

EMARGINATE PETALS. — Two factors influence the dividing of the petals: S. determined it, while G inhibited it. The possible formulae of homozygous individuals with petals with entire borders would be: GG SS GG ss or gg ss. where the formula of the individuals with emarginate petals would be gg SS.

In the heterozygotic condition G tends to over-rule S, hence the forms are entire, or slightly indented. The scheme is as follow:

P: G G *s s* entire × *g g* S S indented
F_1: G *g* S *s* entire to cut.

F_2:
1 G G S S entire
2 G G S *s* »
1 G G *s s* »
2 G *g* S S cut-entire
4 G *g* S *s* entire-cut
2 G *g s s* entire
1 *g g* S S indented
2 *g g* S *s* indented-cut
1 *g g s s* entire

COLOUR OF THE FLOWERS. — All the shades and variations of colour which occur so frequently in the flowers are due to two fundamental colours, red and purple, which are determined by two genetic factors termed by the author, R and V respectively. As regards the distribution of the colour, two regions are to be distinguished, the border and the central spot. The relative development of these two regions, even when the colour is the same, may give rise to different colour effects.

Each of these factors R and V is always regularly dissociated in F_2 according to the scheme:— 3 purple : 1 not purple and 3 red : 1 not red. The colour produced by these determinant factors is, however, far from being uniform, and varies from light-red to scarlet, and from pale violet to deep purple in the same hybrid generation, and under the

same conditions of soil and exposure. This may be explained by the presence of two intensifying factors that alone would have no effect, but which, added to the fundamental factors R and V have the power of intensifying the colours. The deepest colours are always dominant as regards the palest ones.

GREEN STRIPING OF PETALS. — In 1912, in a group of poppies of the " Bride " variety with single, white, emarginate petals, there appeared one individual with petals striped with green. By self-fertilisation, offspring were obtained consisting entirely of individuals with petals striped with green. By crossing, striped and white hybrids were obtained in the ratio of 3 : 1 in the F_2.

Supposing the existence of a factor U that inhibits green stripes and indicating its absence by u we have the following scheme :

P : U U un-striped × *u u* (emarginate) striped
F_1 : U *u* without stripes, or with very faint stripes
F_2 : 3 un-striped, or slightly striped : 1 (strongly) striped.

The author has been able to discover the existence of special factors for the following characters : White stripes ; polycarpy and concrescence of sepals. The data obtained are, however, not sufficient for it to be possible to determine exactly in what manner these characters are transmitted.

57 - **Colour-Changes in Flowers Connected with Sex in Some *Dianthus* Hybrids.** — BLARINGHEM, L., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXIII, No. 20, pp. 892-893. Paris, June, 1920.

From *Dianthus barbatus* L., there have been obtained, by means of crossing and selection, numerous ornamental varieties with flowers varying in colour from blackish-brown (var. *nigrans*) to white (var. *candida*), as well as others with mottled, spotted, striped, and parti-coloured blossoms. In some individuals, their hybrid origin is betrayed by mosaic dissassociation phenomena.

The author carefully studies the characters of a plant that, in 1919 and 1920, produced floral shoots bearing both red and white flowers. Thus on one branch, there were 10 white flowers in violent contrast to 10 bright red ones, and it was only by very attentive examination that the gradations of colours could be distinguished : 5 yellowish-white, 4 white inclining to pink, 6 bright-red, and 9 flame-coloured. In spite of the contrast between the colours and contrary to what occurs in cases of mosaic inheritance, all the flowers, as they grew old, passed from one colour to the other.

The colour changes are a function of the sexual evolution of each flower. *Dianthus barbatus*, is hermaphrodite and dichogamous, with pronounced protandry. In the climate of Paris, there is about a week between the male phase with open anthers, and the female phase, when the style emerges. These two phases are manifested by the colour of the flowers. The petals, in the floral bud, are greenish-white ; 24 hours later, they open without change of colour, and after having attained $^2/_3$ of

their ultimate dimension, the filament of the first stamen elongates, and the anther opens; next day, two stamens are open, and in 5 to 8 days, according to the temperature, all the anthers are completely mature. At this time, the styles are not yet capable of functioning.

When this phase is concluded, the colour of the petals changes suddenly, and in 2 or 3 days, they become bright red; the anthers wither and fall, whereas after 24 hours have elapsed, the styles rise 5 mm. above the level of the corolla. The red colour lasts till the fall of the petals.

Variations in colour connected with the age of the flowers have also been observed in the case of *Pulmonaria vulgaris*, *Myosotis versicolor*, *Weigelia rosea*, *Ribes sanguineum*, etc.

858 – **Pollen and Pistil Development in Relation to Sterility in Pure Forms and Hybrids of the Plum.** — DORSEY J. M. in *Genetics*, Vol. IV, No. 5, pp. 417-487, pl. IV. Princeton, New Jersey, Sept. 1919.

Apart from outside influences, there are others having a direct bearing upon the germ plasm and therefore on reproduction, and hence upon fruit formation

The author reports the results of a study of the sterility in the plum in relation to the development of pollen and pistil.

POLLEN DEVELOPMENT. — Pollen development was studied in varieties representing: *Prunus americana*, *P. nigra*, *P. triflora*, *P. domestica*, *P. pennsylvanica*, *P. hortulana Mineri*, and *P. Besseyi*.

With the exception of certain *P. domestica* varieties, self-sterility in the plum is the normal development and to ensure fructification, cross pollination is necessary.

Biological research demonstrates that abortion occurs in most cases between the time of liberation of the microspore from the tetrad and maturity, in other words during the gametophyte generation, the fact that anther development is normal even when pollen abortion is complete or very evident, tends to eliminate conditions in the anther as a constant factor in abortion. In extreme hybrid forms, there is evidence of pollen disintegration as early as the dyad stage. The frequent breaking down of pollen into yellowish gummy globules should be considered as a supplementary enzymatic process entirely distinct from true abortion, since it does not always occur, and sometimes affects mature grains which have every appearance of being normal. The metamorphic process of petalody does not affect the stamen dehiscence and a new type of aborted pollen is not introduced. Aborted pollen varies in quantity up to a considerable amount and appears to be greatest with extreme hybrids.

In the following Table, the individuals of the crosses between *P. triflora* and *P. americana mollis* are classified according to the percentage of aborted pollen found. The two varieties of *P. triflora*, Abundance and Burbank were used as the pistillate parent.

Consequently in every case, the percentage is very high.

The following data concern the various crosses both between distinct species and also interspecific crosses.

	Number of trees	Percentage of aborted pollen																
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
Abundance × Wolf	34	2	3	4	9	4	5	2	1	2	1		1					
Burbank × Wolf	23	4	1	3	1	2	3	3	1			2		1		1		1

« Aitkin » (*Prunus nigra*) 22.0 % — *Amygdalus nana* × *P. persica* 84.4 % — « Blush » (*P. americana*) 12.0 % — « Burbank » (*P. triflora*) 3.2 % — « Cheney » (*P. nigra*) 54.1 % — « Compass » (*P. Besseyi* × *P. hortulana Mineri*) 43.5, 100.0 and 57.3 % — « De Soto » (*P. americana*) 7.5 % — « Etopa » (*P. Besseyi* × *P. triflora*) 24.0 and 12.1 % — « Irondad » (*P. americana*) 14.2 8.6 and 9.9 % — « Loring » (*P. triflora* × *P. americana*) 26.0 % — « Manitoba » (*P. nigra*) 14.5 % — « Ocheeda » (*P. americana*) 6.3 and 28.8 % — « Opata » (*P. Besseyi* × [*P. Munsoniana* × *P. triflora*]) 80 % — *P. americana* (*selvatica*) 21.5, 14.5 and 14 0 % — *P. angustifolia* 18.1 % — *P. Besseyi* 12.3 % — *P. Besseyi* × *P. americana* 63.7 % — *P. Besseyi* × *P. armeniaca* 87.6 and 82.3 % — *P. Besseyi* × *P. Simoni* 35.1 % — *P. nigra* 24.1, 37.9 and 3.6 % — *P. pennsylvanica* 26.4 % — *P. virginiana* 15.0 and 7.3 % — « Rollingstone » (*P. americana*) 9.7 % — « Sapa » (*P. Besseyi* × *P. triflora*) 42.0 % — « Surprise » (*P. hortulana Mineri*) 34.0 and 7.0 % — « Wolf » (*P. americana mollis*) 23.0 % — « Wyant » (*P. americana*) 16.5 and 18.2 % — « Yellow Egg » (*P. domestica*) 3.1 %.

	Percentage of aborted pollen																			
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Hybrids	1	1			2		2	1	1		1		1			2	1	1		1
Pure forms	6	5	6	4	3	1					1									

As a general rule, except in the case of the extreme hybrid, *e. g.* Compass (*Amygdalus nana* × *P. persica*) and Opata (see above), where the pollen abortion is practically complete, abortion should not therefore be condemned as the prohibitive factor in the setting of fruit in the case of self-pollination as much as with cross pollination.

Moreover, in view of the extreme hybrid condition of many varieties, abortion of pollen may be considered of great economic importance. The abortion of pollen during the haploid stage appears to point to the conclusion that the cause of abortion is to be found in the condition of the germ plasm of the gametophyte.

Pistil development in relation to sterility. — After having first described the normal development of the pistil, the author speaks of the dropping of the pistil which occurs at three distinct stages :

(1) Immediately after bloom. The flowers which drop at this stage show aborted pistils, and this abortion in some cases takes place

very rapidly, whilst the pistil is still short, not more than 5 mm. long In other flowers the pistils measure a normal length, but both ovules are aborted. The pollen, on the other hand is usually normal.

(2) Two to four weeks after bloom, all the pistils drop off, and for certain reasons, pollination has not taken place. It is interesting in this case to note the appearance of the ovules; for about two weeks the nuclear condition remains normal followed by disintegration in the antipodal nuclei and then in the endosperm nuclei. The embryo sac elongates only slightly, whilst on the contrary, the canal extends as a rule as far as the chalazal. The ovary, before dropping, reaches a size of 2 to 5 mm. in diameter.

(3) June drop. — Two weeks later than the second drop. The small fruits are already formed; pollination has taken place, but the embryo development has been hindered. Therefore in a perfectly normal manner, before or immediately after bloom, one of the two ovules is in each ovary suppressed.

Elimination of Gametes. — Owing to abortion of pollen, pistils, and ovules, a considerable number of gametes are eliminated. To what cause can this be attributed? As a result of the most recent study on this phase of the subject, evidence has been presented that certain factor combinations in heterozygous lines of descent exist which cannot undergo normal development. As regards the heterozygous condition of the genus *Prunus*, the variability is evident in fruit and other characters shown by wild seedlings of *Prunus americana*, *P. Besseyi* and *P. nigra*, as well as studies of a large number of F_1 descendants of controlled interspecific crosses.

Relationship of varieties and species. — Various crosses demonstrate the genetic relationship between the setting of fruit and the dropping off of pistils or small fruits.

Thus, for Compass × Burbank, out of 175 flowers artificially pollinated, 116 fruits set, whilst for Minnesota No. 9 × Minnesota No. 12, out of 537 flowers pollinated, none set. Between these two examples, there is a series of intermediary results. But an aborted setting is not always accompanied by an abundant yield of ripe fruits. For Compass × Burbank, from the 116 fruits set, some 114 mature fruits were obtained, but Compass × Yellow Egg which possessed an equally high setting percentage (out of 1327 flowers pollinated, 652 fruits set), only gave a very low number of mature fruits (8).

This appears to support the hypothesis that certain factor combinations are only able to develop to a certain limited extent, some failing in the zygote, some in the embryo, and some not until the time of formation of the ovule or of the pollen.

Type of sterility in the plum. — Considering only the pollen grains of normal appearance which reach the stigma under ordinary conditions, some do not develop pollen tubes, whilst others are normal in this respect. In a similar way, some produce microspores and others do not. These differences instead of proceeding from a substratum

which in every case is identical in nature, are apparently due to a similarity in the character of the pollen grains, and may be explained by the variation genetically. The fact that there is a marked occurrence of self-sterility in the American varieties does not demonstrate that this condition or character is dominant. However, there are also cross-fertile and cross-sterile groups as in *Nicotiana* and other species. Inheritance studies of sterility bring to the front the importance of the physiology of pollen tube growth which behaves in a way similar to other inherited characters investigated. There seems to be no doubt now concerning the segregation of a character at the time of reduction division, which would produce a difference between pollen tube and stylar tissue, which results in a type of sterility that is merely a physiological impediment. The type of self and cross sterility in the plum, is therefore comparable with that in other forms, and can be ascribed to slow pollen tube growth.

859 – **A Turbine Sorter for Seeds.** — I. RINGELMANN, Selection des blés au trieur, *Comptes rendus de l'Académie d'Agriculture*, Vol. VI, No. 19, pp. 477-478. Paris, May, 1920. — H. ZACHAREWICZ, ED., *Ibid.* pp. 489-491. FEEDS

M. RINGELMANN reports the opinion of the Rural Engineering Section as regards M. ZACHAREWICZ's suggestion of using a turbine sorter for seed-wheat.

The ordinary sorter divides the seeds according to their length and width, but without any regard to their weight, which is a third very important character in wheat used for sowing.

The MAROT turbine sorter allows of bad, light grains being separated from good seeds, which are of the same size.

The so-called air-turbine, or turbine fan, can be affixed to all sorters, and has nothing to do with the small fans or winnowing-machines, that merely remove the dust, husks, and chaff.

The results obtained by M. ZACHAREWICZ with Manitoba wheat are given below :

	Weight per hectolitre	Proportion
	kg.	
Before sorting	78.0	100.00
Sorted with ordinary sorter (without turbine)	79.5	101.92
Sorted with turbine-sorter	80.0	102.56

The ordinary sorter gives an increase of weight, per unit of volume, of 1.92 % with grain that has not yet been passed through the machine; the increase in weight due to the action of the turbine is slight (0.64 %).

In some experiments with the Marot honey-comb sorter, M. ZACHAREWICZ obtained the following results, after adjusting the apparatus in such a way as to obtain the best work :

In these experiments, carried out without a turbine, and with an agricultural type of sorter, the increase in weight per unit of volume of the seed-wheat due to sorting varied from 1.3 to 5.3 % according to the original weight of the grain.

	Weight of hectolitre		Proportion	
	Before sorting	Seed wheat	Before sorting	Seed wheat
	kg.	kg.		
Local wheat (Deux Sèvres): 1st lot . . .	74.6	78.6	100	105.3
Local wheat (Deux Sèvres): 2nd lot.	76.0	77.0	100	101.3
Saumur March wheat (sold for seed). . .	76.0	80.0	100	105.2

860 – **The Canadian Government Seed Purchasing Commission.** — CLARK, G. H. (Seed Commissioner, Seed Branch, Department of Agriculture, Dominion of Canada), in *The Agricultural Gazette of Canada*, Vol. VII, No. 3, pp. 220-221. Ottawa, March, 1920.

The Canadian Government Seed Purchasing Commission which was considered as a war time organisation, under the Branch of the Seed Commissioner, has continued in operation this season in an endeavour to take care of the seed distribution in the Prairie Provinces. In former years, the Commission had also traded with seed coming from the Canadian Government Elevators at Port Arthur, Quebec and Montreal. It is anticipated however, that now, private grain and seed firms, together with the co-operative organisations are capable of rendering efficient service in respect to the seed demand in Eastern Canada. Seed inspection for the established grades of seed grain continues to be available at Canadian Government Elevators to private and co-operative dealers, on the same basis as to the Commission.

Under normal condition of trade, the Canadian people might oppose the idea that the government should interfere with such commercial transactions. It is contended by some, that private companies have not in past years provided a service in respect to seed supply, sufficiently comprehensive to meet the requirements of agriculture. Semi-public organisations of farmers, with a co-operative basis have developed rapidly under the extraordinary conditions of wartime trade. When these organisations become firmly established, they will doubtless under Government control be able to provide seed supplies more efficiently, and with greater satisfaction than can be expected of any governmental organisation. Even now, the distribution of seed grain and other seeds is affected and prices controlled by farmer's co-operative organisations.

The Commission has without doubt rendered valuable service to Canadian agriculture during the trying years of the war, when, notwithstanding extraordinary conditions both in regard to supplies and transport, there was at no time a seed shortage in any part of Canada. Obligations and risks which appeared to be necessary to protect agricultural interests were frequently assumed by the Commission. This course of action could not be expected of private companies, and naturally resulted in losses in connection with several minor transactions. The consolidated balance sheet, however, covering the operations of the Seed Purchasing Commission for the past three years shows a small surplus.

The total sums advanced by the Department of Finance, Canada, for the purchase of seed supplies, on requisition for the Dominion Seed Commissioner amounted to $11 896 540.96, and the total of refunds to the Receiver-General from the proceeds of sales was $11 903 437.76. Net assets, including seed grain in storage were valued at $37 888.85. The salaries and expenses of the experienced Seed Branch officers, comprising the staff of the Commissioner, were not charged against the cost of the seed. The order in council which established the Commission, directed that the seed supplies should be purchased, stored, cleaned, and sacked where necessary, and sold at the net cost as nearly as might be determined.

The Commission started work in October, 1916, ending in September, 1919, not taking into account the above mentioned emergencies. The business included the purchase and sale of seed wheat, oats, barley, rye, maize, peas and beans, subject to inspection based on the established grades for seed grain provided under the Seed Control Act. Inspection was administered by the Seed Inspection Division of the Seed Branch: Every car load purchased or sold was examined by seed inspectors, and samples were submitted for tests as to purity and germination by the Dominion Seed Laboratories at Ottawa, Winnipeg, or Calgary. Delivery consisted of a bill of lading, licensed weighman's certificate, seed certificate and sight draft. This system of meeting emergency situations was adopted on the recommendation of the Seed Commissioner. It is based on the establishment of official seed grades for grain, and on the principle that municipal governing bodies, supported by their provincial government are in the best position to deal with the extension of credits to needy farmers.

CEREALS AND PULSE CROPS

861 – The Yield of European Rice-Fields as Compared with those of the Rice-Fields in the Far East. — CHEVALIER, A., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 6, pp. 180-181. Saïgon, June, 1920.

The author's attention has been drawn on several occasions to the very large crops obtained from certain rice-fields in Europe.

At the Rice-Growing Congress held at Valencia (Spain) in 1914, yields of from 7000 to 8000 kg. per hectare were reported from some parts of Spain.

Quite recently. M. P. PAPAGEORGIOU, the Director of the Royal Hellenic Agricultural Station, reported that, in Ancient Greece, and also in Epirus and Macedonia, the average rice crop was from 12 500 to 15 625 kg. per hectare (?). The author struck with these figures (1), which so far exceed the returns recorded in Indo-China, where, under the most favourable conditions, a crop of only 2000 to 2500 kg. per hectare is obtained, applied to Prof. NOVELLI, Director of the Vercelli Rice Growing Station, for information respecting the Italian rice production, and received the following reply:

(1) See *R.*, Feb. 1920, No. 198. (*Ed.*)

" (1) *Minimum, average and maximum yields of Italian rice fields.* — As regard this question, it must be remembered that, in Italy, rice is generally grown in rotation with catch crops, and that in the scheme of rotation, rice is, as a rule, planted for three consecutive years on the same ground. The first year, the most exacting varieties are grown, while the third year the more robust and less productive varieties are planted.

During the first year, the rice-fields produce crops exceeding 70 quintals per hectare; older fields, and those where the soil is less fertile, yield 35 quintals or less; in rice fields of average fertility, from 45 to 50 quintals may be counted upon.

With the planting-out system, when due regard has been paid to the environment, prolific rice-fields of the first year, have yielded above 80 quintals per hectare.

(2) *The present condition of mechanical cultivation in Italian rice-fields.* — On this point M. NOVELLI gave M. CHEVALIER the following information: Of late years, machines have been largely used in the cultivation of rice fields, especially petrol and heavy oil tractors; in some rare cases, electric power has been employed for ploughing. For some years past, mechanical seed drills have been used; rice however does best when transplanted.

Some experiments have also been made with mechanical planters and reapers, but the use of such appliances is still restricted.

On the other hand, mechanical threshers, polishers, and driers are very generally used by rice cultivators, who possess excellent machines of these types. "

862 - **Phung-Tiên Rice, Variety Selected at the Cantho Rice Experiment Station, Cochin-China.** See No. 853 of this *Review*.

863 - **Yield of Different Varieties of Oats in New South Wales.** — PRIDHAM, J. T., in *Agricultural Gazette of New South Wales*, Vol. XXX, No. 11, pp. 777-780. Sydney, Nov. 3, 1910.

Brief report of the results of experiments with different varieties of oats (either grown for grain, hay or fodder), conducted at various Experiment Farms in New South Wales, during a 5 year period, 1914-1918 The Algerian appears to be the most productive variety in districts of assured rainfall; the New Zealand variety Ruakura gave the best results on the coast.

Highest Yield of Chief Varieties of Oats Studied.

Variety	No. of Trials	No. of times showing highest yield	Percentage of number of times showing highest yield
Algerian	71	25	35.21
Ruakura	38	14	36.84
Guyra	37	10	27.02
Sunrise	60	15	25.00
Lachlan	26	3	11.53

864 - **Suburban Forage Crops in Cochin-China and the Philippines** (1). — VIEILLARD, P. (Director of the Genetics Laboratory of the Scientific Institute of Indo-China) and TRAN-VAN-HU (Assistant at that Laboratory), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 6, pp. 161-167. Saïgon, June, 1920.

In a report on the work done in 1910 by the Agricultural and Commercial Services of Cochin-China of which he is the Director, M. MORANGE wrote (2):

" Excellent results have been obtained at Phumy from the cultivation of forage Gramineae, and it appears likely that it would pay to grow similar crops in the neighbourhood of Saïgon during dry seasons, provided care were taken in the choice of the soil, since the native dry-season fodders, which are sold at the rate of 7 *piastres* per 1000 kg., are of very inferior quality. "

The authors have considered M. MORANGE'S suggestion, and their observations are based upon 3 series of facts :

(1) The present condition of the Saïgon green forage market.

(2) The results obtained from forage crops grown from 1911 to 1916 at the Phu-My Station, situated just outside Saïgon.

(3) The condition of forage cultivation in the Philippines.

I. *The Green Forage Market at Saïgon.* — The present number of horses in the towns of Saïgon, Cholon, and Giadinh, is about 2000. The total number of the horses and mules of the towns of Saïgon, Cholon, and the province of Giadinh would appear to be 2739.

It may be reckoned that scarcely one quarter of the horses of these centres of population are fed on imported hay, or on grass regularly grown for the purpose. The other three quarters live on grass sold in bundles and taken daily to the stables by natives, who make this their occupation.

The grass is found to some extent everywhere ; a great deal of it comes from the banks of the *arroyos*, or of the Saïgon river, as well as from abandoned, or fallow. rice fields, and even from lawns round the villas, as they are carefully cut until they become quite burnt up by the drought The grass is transported on sampans (native boats), and is taken in carts to the various customers.

The price per bundle varies from $0.20 in the rainy season to $0.30 in the dry season, so that the price per metric ton is from 6 to 10 *piastres*.

The average daily ration for a horse is 30 to 40 bundles of 250 to 350 gm., that is, about 10 kg. but it would certainly be increased in the dry season, were it not for the lack of forage. The forage thus collected and distributed, naturally varies greatly in quality ; it consists chiefly of *Gramineae ;* there are few *Leguminosae*, but owing to its growing on marshy land, some *Cyperaceae* are found mixed with them.

Taking the total number of the horses belonging to Saïgon, Cholon, and Giadinh which are fed on this cut forage, and reckoning the daily ration of each animal at 10 kg., we find that 15 tons of green fodder are

(1) This study is of a general character, and deals with a question that is of interest to large number of colonies where the climate is hot.

(2) *Bulletin économique de l'Indochine*, 1910, p. 627. (*Ed.*)

required each day, and that its cost varies, according to the season, from 90 to 150 *piastres*. A great deal of this fodder could be obtained, particularly during the dry season, from special crops grown near the town. Of this the experiments carried out at Phu-My are a proof.

II. *The Phu-My Station Forage Crops.* — For 6 years, from 1912 to 1916 inclusively, the green forage crops cut to be fed to the stock animals and those of the collection in the Botanical Gardens were carefully weighed (the results being calculated per hectare) which afforded some interesting comparisons. The figures referring to Para grass and Guinea grass could be taken as they stood, for the plots under these *Gramineae* varied from 10 to 60 *ares*. The figures obtained for the other forage plants were of less value, as only small plots of several *ares* were sown for each experiment.

The average annual crops for the 6 consecutive years were almost the same in the case of Para grass and Guinea grass, viz., from 60 000 to 70 000 kg., per ha. Pastures of Guinea grass appear to deteriorate more quickly than those of Para grass. In addition to the above-mentioned amount of green forage, the pastures formed of these *Gramineae* furnished a considerable number of shoots every year (sometimes many more than 100 000), which were distributed among Associations, or private individuals, in order to stock new pastures.

The results given by the other forage plants from 1912 to 1916 are as follows (the figures in brackets beside the annual yields of green fodder show the number of cuttings) :

Panicum plicatum. . . . 12 400 (1) in 1912; — 14 900 (2) in 1913;
Aleppo sorghum . . . . 8 100 (2) in 1912; — 41 000 (3) in 1913 — 20 000 (1) in 1914;
Miscanthus sp. . . . . 40 600 (1) in 1913; — 27 600 (1) in 1914;
Perennial Senegal rice . 26 100 (2) in 1914;
« Fayotier » . . . . . 142 000 (7) in 1913; — 33 400 (4) in 1914 — 9 500 (1) in 1915 — 6250 (1) in 1916;
Leucaena glauca . . . . 115 300 (5) in 1913; — 76 500 (6) in 1914 — 31 500 (4) in 1915 — 46 900 (6) in 1916;
Aeschynomene sp. . . . 7 500 (1) in 1913; — 42 800 (4) in 1914;
Albizzia occidentalis. . . 13 000 (1) in 1913; — 34 300 (2) in 1914.

The experiments have proved that forage crops can be grown in the immediate vicinity of Saïgon with every chance of success. Agriculturists cultivating them will be certain to find a ready market for the produce of 50 hectares of rice-field turned to this account, and will obtain good prices either by the direct, daily sale of the green fodder, or by contracting to supply it, and also hay to the Military Authorities or the Public Services.

III. *Suburban forage crops and hay production in the Philippines.* — By way of example, in order to show what may be done along these lines, the authors give a summary of an article published on the same subject in the Philippines, in the *Philippine Agricultural Review*, No. 2, February, 1918 by Mr. C. M. Conner, Head of the Agronomic Division of the Department of Agriculture in the Philippines. The native horses

of these islands are fed on green fodder (*zacate*) of different kinds : — " barit " (*Leersia hexandra*), " luyaluya " (*Panicum repens*), and " manimanian " (*Alsicarpus*). The forage crops dealt with in this study is *Leersia hexandra*, there being an area of 500 hectares of meadow-land near Maniba under this *Gramineae*.

These crops are grown on plots treated in the same manner as ricefields. The soil is ploughed 2 or 3 times and harrowed, then the water is let in, and kept standing for several days at a depth of 10 cm., until the soil is transformed into mud. " Barit " (*Leersia hexandra*) is gathered in a field set apart for the purpose, and carried in bundles to the field to be planted ; the bundles are opened, and spread out one next the other, their bases being buried in the mud. At the end of the operation, the field looks as if it were covered with straw. The water is again let in and kept at the same height, until the plants have revived, when the field is left to itself.

The forage can be cut for the first time from 8 to 10 weeks after transplanting. The other cuttings are made every 6 or 7 weeks. The grass is tied up in bundles of about 6 cm. in diameter, which are bound together in large bales that can be carried to the town by two men.

The average annual yield is from 50 to 60 tons per hectare. Manila, however, does not entirely depend upon locally grown forage : as in Saïgon, boats arrive every day bringing to the city fresh grass cut in the lake district, or in the neighbourhood of Santa Cruz.

865 - **Fodder Trees and Shrubs for South Africa.** — LEPPAN, H. D. (Transvaal University College, Pretoria) in *The South African Journal of Industries*, Vol. III, No. 4, pp. 334-343, bibliogr. of 15 works. Pretoria, April, 1920.

The author deals with the following points : the chief limiting factor of agronomic production (which in South Africa is represented by the rafnfall) ; dry land farming ; indigenous fodder crops ; methods of grazing ; exotic species : useful stock fodder crops ; a proposed experimental station at Kalahari.

In the parts of South Africa having more than 15 in. of rainfall per annum, the ordinary fodder crops grow quickly and well, and consequently it are more profitable than trees and shrubs. Where, however, the annual rainfall is decidedly less, it is necessary to have recourse to such plants. It is true that even there, it is possible to cultivate the two most drought resistant plants in South Africa, namely sorghums and millets, but only with the utmost care ; this necessitates an expensive outlay and even then normal yields are produced only once or twice in 5 years.

South of latitude 22°, fully half of South Africa is arid : Going from east to west of longitude 24°, with the exception of the south-western corner of the Cape, the rainfall decreases from 15 in., to less than 1 in. along the coast of the South-West Protectorate ; in the same direction it changes from a summer to a winter precipitation. The extremely high temperatures prevailing in the east together with the high summer evaporation and torrential character of the rainfall, render growth of

fodder crops too precarious an undertaking. Towards the Western portion in Namaqualand West, the rainfall is only about 8 in. per annum. Since, however, this occurs almost entirely in winter, and is of a misty character, cereals and vetches can be grown under sparse sowing conditions, sufficient to mature on a small amount of available moisture. Wheat sown at the rate of 7 to 10 lb. per acre should give a only about 250 lb. per acre. The cost of production under these extensive methods of cultivation is very low; and the total production is also limited.

The fodder plants of South Africa include numerous trees and shrubs, which even in the less arid regions furnish food for the livestock during periods of drought: for example:— Ganna Bos (*Salsola zeyheri*) in Karroo; various species of *Mesembryanthemum* in Namaqualand; *Acacia horrida* and *Cussonia spicata* in the Eastern Province.

The principal fodder plants which have been tried with success in some of the driest parts of South Africa are as follows:— Old Man Saltbush (*Atriplex nummularia*) and Creeping Saltbush (*A. semibaccata*), introduced from Australia, both very tolerant of soil alkalinity *Opuntia* spp. introduced chiefly from Mexico, Spekboom (*Portulacaria afra*), an indigenous perennial found in the eastern parts of Cape Province — *Mesembryanthemum floribundum* and other indigenous species; — Goed Karroo (*Pentzia virgata*) found in Karroo; — Mesquite (*Prosopis juliflora*) and Screw Bean (*P. Pubescens*), species introduced the first self propagated in the South-West Protectorate; — Carob tree (*Ceratonia siliqua*).

The following plants, indigenous to South Africa have been used for grazing purposes, but do not offer equally satisfactory results as those in the preceding list: — Kiepersol (*Cussonia spicata*), Zoetdoorn (*Acacia horrida*), — Wild Olive (*Olea verrucosa*), — Rozyntjebos (*Grevia cana*), — Narranarra (*Acanthosicyos horrida*), — Vaal Karroo (*Phymaspermum parvifolium*) Vaalbos (*Tarchonanthus camphoratus*), — Karreboom (*Rhus viminalis*), — Draai-bossie (*Aster filifolius*): — Cape Saltbush (*Atriplex capensis*)

The four undermentioned species have been introduced and tested in South Africa: — Tagasaste (*Cytisus proliferus*) which seems to require a cooler and more humid climate than that found in South Africa; — *Atriplex halimoides, A. leptocarpa, A. vesicarium* which have succeeded well in the Orange Free State, but these are annuals and grazing must be watched carefully (especially as stock eat these with avidity), otherwise self propagation will cease; farmers therefore prefer the perennial species.

Acacia aneura, Jacksonia cupulifera and Kurrajong (*Sterculia diversifolia*), have proved most useful in Australia during droughts, and the author considers them worthy of trial in South Africa.

866 – **Losses of Organic Matter in the Preparation of Brown and Black Alfalfa.** — Swanson C. O., Call L. E., and Salmon, S. C., in *Journal of Agricultural Research*, Vol. XVIII, No. 6, pp. 299-304. Washington, D. C., Dec. 15, 1919.

The product resulting from the stacking of alfalfa in a partially wilted condition is known as brown and black alfalfa. The stacking

excludes the air, and fermentations occur similar to those which occur in a silo. The degree of colour thus obtained depends upon the conditions which control the nature and extent of the fermentations such as ; moisture content of the alfalfa when stacked, size and shape of the stack, and temperature and rainfall during the time of curing, etc. Both brown and black hay are relished by cattle.

Each time, however, that fermentation occurs, there is evidently a loss in nutritive value. Since the nature and amount of these losses were unknown, the authors decided to investigate them, and also to compare the feeding value of these hays with that cured in the ordinary way. These investigations were carried out at the Kansas Agricultural Experiment Station.

The alfalfa was cut and left to wilt for some hours and stacked in the open. Towards the latter part of December, a sample was put to the test ; one quarter was analysed, and the three other quarters fed to steers. The remainder was left intact and a sample was taken towards the end of March to be analysed.

The average dry matter content of the partially wilted alfalfa put into the stack was 46.72 %. The loss increases with the length of time in the stack and with the changes during fermentation.

Alfalfa which has become black as a result of fermentation is very inferior as a feed for steers in comparison with ordinary alfalfa hay of good quality and with the brown hay.

The feeding tests were carried out with 3 lots of 14 steers each covering a period of 180 days. The following concentrated rations were used :— shelled maize and oil meal ; roughage ; alfalfa hay. The average daily gain, per head per lot, fed with black, brown and ordinary hay was 262.1, 350.1, and 353.8 lb. respectively.

867 – **Hemp-Growing in Tran-Ninh, Indo-China.** — Miéville, R. in the *Bulletin agricole de l'Institut Scientifique de Saïgon.* Year II, No. 5, pp. 157-159. Saïgon, May, 1920. FIBRE CROPS

At the present time, hemp is exclusively cultivated in Indo-China by the Meos, and only for their own requirements. The hemp grown by them is *Cannabis sativa* L., the so-called " Chinese Giant hemp ". The male and the female inflorescence grow on separate shoots. Its average height is from 3 to 4 metres ; when left to bear seed, it may grow to 6 metres, the diameter of the stem being from 4 to 5 cm. at the collar. If grown sufficiently far apart, *Cannabis sativa* assumes a pyramidal form, its base covering an area of from 2 to 3 metres. In the hemp crops at Tran-Ninh, about $^2/_3$ of the shoots are male and $^1/_3$ female.

Cannabis sativa is cultivated in the mountains, at altitudes between 1200 and 2000 metres, and especially in forest clearings situated at the bottom of ravines, on account of the large humus content of the soil in such places.

The Meos gather the stems 70 days after sowing, which is too early. They always leave some plants on the edges of the fields, to provide seed for future crops. The natives know nothing of retting, but extract the fibres by hand.

At Tran-Ninh, no pond is required for setting the stems, all that is necessary being to leave them lying on the fields, where they are macerated naturally by the action of the rain on dew. The stems have only to be turned every 2 or 3 days, and retting is complete in from 8 to 12 days.

The author has made experiments in growing hemp. This plant does not appear to depend on altitude as much as has been supposed, for fine specimens have been obtained at an altitude of only 450 metres.

After setting and scutching, the author obtained 6 kg. of tow per 100 kg., of dry stems (in France, according to a paper published in the *Bulletin économique de l'Indochine*, No. 51, New Series, 1906, dealing with the textiles of Tran-Ninh, 35 kg., of tow was furnished per 100 kg., of dry stems on ordinary soil, and 50 kg., on rich soil).

868 – **Note on Cambodian Cotton** (1). — PRUDHOMME, E. (Director of the Jardin Colonial de Nogent-sur-Marne, France), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 6, pp. 182-184. Saïgon, June, 1920.

M. DE FLACOURT (Inspecteur, Chef des Services Agricoles et Commerciaux du Cambodge) sent, in July, 1919, to the Colonial Garden for examination by experts, three types of Cambodian cotton (*Gossypium hirsutum*) obtained through selection carried out by the Department of Agriculture of the Protectorate.

As in a previous case (2), the Colonial Garden requested M. Ch. MARANDE, Vice President of the Colonial Cotton Association, to examine the samples, and the author gives an account of this examination.

The three types of cotton showed a quality at least equal to that of the samples examined in 1918. They are classed "fully good middling" to "middling fair." The fibres are fairly long, and in due recognition of the length, M. MARANDE emphasises the importance of producing cotton with a good staple running from 28-28/29 and 28/30 mm., which forms the basis of the French consumption as well as of other countries.

PLANTS YIELDING OILS, DYES, TANNINS ETC.

869 – **The Exploitation of the Oil Palm *(Elaeis guineensis)* on the Ivory Coasts.** — TEISSONNIER, (Chef du Service de l'Agriculture, Bingerville), in the *Annales de l'Institut Colonial de Bordeaux*, pp. 69-78, Figs. 4. Bordeaux, 1919 (1).

Of the Colonies under the jurisdiction of the General Government of French West Africa, the Ivory Coast occupied the first place as regards climate, soil fertility, and the methodical utilisation of the numerous natural products found there. The products of the oil palm (oil and palm-oil) give rise to exports valued at 200 000 000 francs. The enormous stands of these trees on the Ivory Coast have scarcely been touched; they, however, represent a large source of wealth and, further, a very sure one, as there is no limit to the demands of commerce. The appended table gives the exports of the Colonies of French West Africa, and show

(1) As regards Cambodian cotton, see "The Possibility of Developing Cotton Growing in Cambodia" by M. de FLACOURT, *R.*, Dec., 1918, No. 1355. See also *R.*, Jan., 1919, No. 46 and *R.*, May, 1919, No. 595.

(2) See *R.*, April, 1920, No. 423. (*Ed.*)

(1) See *R.*, April, 1920, No. 423. (*Ed.*)

that Dahomey exports much more of its palm products than the Ivory Coast, although the zone suitable for the cultivation of the oil palm is smaller, but in Dahomey the population is larger and the palm-groves are better tended.

Year	Guinea	Ivory coast	Dahomey	Total
	Tons	Tons	Tons	Tons
		Palm oil.		
1910	15	5 055	14 630	20 640
1911	10	6 625	15 250	21 885
1912	140	6 775	11 950	18 835
1913	165	6 015	7 970	15 150
1914	105	4 310	6 620	11 035
1915	375	4 965	9 595	14 955
1916	320	6 950	12 635	20 105
1917	265	6 260	11 865	18 399
		Palm-nut cake.		
1910	4 580	5 425	34 785	44 785
1911	4 825	5 250	39 345	49 420
1912	5 135	6 800	37 295	49 230
1913	5 170	5 950	26 370	38 490
1914	4 715	5 650	21 240	32 616
1915	505	6 115	23 225	29 845
1916	5 960	7 955	28 476	42 390
1917	7 070	6 130	17 017	30 216

Elaeis guineeensis is unusually dependent on the care it receives, and in the colonies of French West Africa, it has never been cultivated scientifically. Although these colonies derive great advantages from the fact that the oil palm grows wild, they will soon be outdistanced by the Dutch Colonies, where a remarkable system of cultivation has been evolved, unless they make efforts to increase the output.

Without there being any immediate danger of such a contingency, it would, however, be wise to study the situation, and not to rely exclusively upon the wild stands of oil palms, though at the same time, the natural benefits accruing from their existence should be turned to the best account.

In short; the systematic exploitation of the oil palm should include: (1) The care of natural palm-groves; (2) the selection and propagation of varieties with large yields; (3) regular cultivation; (4) the installation of oil-factories. With the exception of selection, the rest of the programme could easily be carried out; all that is required is good will. The management of the palm-groves, which has already been begun in the lagoon zone, will give appreciable results from the end of next year, and the natives will lose no time in observing and valuing them.

870 – **Improved Methods of Cultivating the Groundnut in Senegal.** — I. Report of the Mission, CHEVALIER, A. (Head of the Permanent Colonial Agricultural Mission), in the *Bulletin des Matières grasses de l'Institut Coloniale de Marseille*, 1920, No. 2, pp. 61-74. Marseilles, 1920. — II. La lutte contre les insects attaquant l'arachide, ROUBAUD E., (Chief of Service of the Pasteur Institute), *Ibid.*, pp. 74-83. — III. Note sur la selection des arachides, VUILLET (Director of the Agricultural Services in Upper Senegal-Niger), *Ibid.*, p. 84.

Some years before the war. consternation was aroused in Africa and France among persons engaged in the groundnut trade and industry by the deterioration of the groundnuts of West Africa, and the decrease in their oil content (1).

The Colonial Institute of Marseilles urged the Governor-General of F. W. A. to have the question investigated by thoroughly competent experts ; M. A. CHEVALIER accordingly made it to the subject of special enquiry, and M. ROUBARD was entrusted with the task of deciding upon the control measures to be adopted against the insect enemies of *Arachis hypogaea*. The reports of these two investigators are published in the *Bulletin des Matières Grasses* of the Colonial Institute of Marseilles together with M. VUILLET'S remarks on the selection of groundnut seed.

I. — REPORT OF M. A. CHEVALIER. — Rubber (2) and groundnuts are the two chief sources of wealth in West Africa, unshelled nuts of *Arachis* being exported annually to the value of 50 million francs, while its straw, which forms excellent fodder, is a very important article of trade in the country itself.

Nearly the whole colony of Senegal finds its means of livelihood in the groundnut trade, from 151 000 metric tons (1907) to 164 900 t. (1911) of unshelled groundnuts being exported annually. The plant is being more extensively cultivated every year, especially along the railway from Thiès to Kayes. Exportation, however, does not keep pace with production. This is due to the deterioration of the quality of the groundnuts, and their smaller oil content, which depend upon the attacks of its animal foes (insects, etc.) and also upon other causes.

According to M. ADAM, Director of the Senegal Agricultural Service, the yield of groundnut grown in the different regions of Cayor has been greatly decreasing for a very long time not only on account of the injuries inflicted by insects, but also because of the following factors :

(1) Soil exhaustion ; (2) diminished rainfall resulting from deforestation ; (3) the invasion of the northern districts by drifting sands. The crops of the Louga region are now of very inferior quality, the nuts being small and not filling up the shells.

The North-East wind also carries moving sands, which ultimately cover the soil, so that the plants cannot grow or are buried

M. ADAM is of opinion that the method of groundnut cultivation practised by the natives will entail the progressive sterility of Senegal for

(1) See, in this connection, the paper by M. ANGOULVANT, *R.*, July-Sept., 1919, No. 888, (*Ed.*)

(2) For African Rubbers and their crêping, see No. 872 of this *Review*. (*Ed.*)

for the following reasons: (1) The natives destroy the trees; (2) they impoverish the soil without restoring (by means of manuring, and fertilising) the nutritive substances abstracted by the crops.

The groundnut, however, is more suitable than any other plant for cultivation in Senegal, where the dry and excessively hot weather prevailing for more than 7 months in the year is only adapted to annual crops of very rapid growth. The rainy season lasts about 4 months and, during this time, from 25 cm. to 75 cm. of rain falls; this is the total annual amount in the districts where the groundnut grows, but it is all that is required for the crop. Further, the soil, which is sandy or a sandy-clay, is very fertile and admirably suited to the plant. As this leguminous plant is especially cultivated in Senegal in districts very far removed from any rivers, or streams, and which could never be irrigated, it would be difficult, if not impossible, to find any other important crop that could replace it.

The groundnut is thus a treasure to the country, but a treasure that requires supervision, and also increasing this is a matter of no great difficulty, seeing that, in the groundnut districts of the colony there are millions of hectares of uncultivated land through part of which the railway from Thiès to Kayes already runs, or will shortly do so.

It is therefore of paramount importance that this plant should be studied, and that the experiments should be resumed which were formerly begun, but had to be suspended.

Serious attempts to plough the land were made in 1898 and 1899, but the outbreak of yellow fever in 1900 led to their being abandoned. In 1905 and 1906, experiments were made in sowing foreign groundnuts from Egypt, Mozambique, and Java, but as the conditions were unsatisfactory, only very meagre results were obtained that admit of no conclusions being drawn.

Since 1907, these experiments have been suspended, and it may be said that no one has troubled any further about the matter.

In order to develop groundnut cultivation, it is necessary to follow the example of the colonists of Malaya, who devote all the resources of special Experiment Stations to the study of the different plants that are the foundation of their wealth (sugar-cane, tobacco, tea, hevea, etc.). The groundnut is of sufficient importance in French West Africa to have a similar Station devoted to its interests.

The Governor-General has approved of the suggestion that such an Experiment Station should be founded, and the local Government Authorities have voted the credit necessary for its establishment and maintenance; it now only remains to organise the work. The author gives some details as to the constitution of this Station and the problems it would have to solve. The programme of the Groundnut Experiment Station should include the following 3 principal branches of research:

(1) *The scientific study of the plant from a general point of view.* — A careful study must be made of every way in which it can be improved. The introduction of seed of foreign varieties; the selection of

these and of local varieties ; the influence of the different soils of the Colony ; the action of various fertilisers ; the question of the spacing of the seed when it is planted ; the different methods of cultivation (especially dry-farming) ; the agricultural implements to be used.

(2) *The special study of the groundnut from the point of view of its cultivation by the natives.* — The production of groundnuts in Africa is entirely the work of the native, therefore it is very necessary to improve his methods of cultivation. Attention must be devoted to the best manner of obtaining seed and implements of a superior quality ; more enlightened cultural methods must be adopted, as well as useful measures of an administrative character, such as the creation of small inalienable holdings, sinking wells and making paths to the railway stations. The natives should be encouraged to emigrate from over-populated regions, like Massa and Fouta-Djalon, markets must be opened for the sale of produce, the number of Cooperative Seed Association and of native Cooperative Credit and Purchasing Societies increased, and prizes and rewards offered to the natives whose crops are in the best condition, etc.

(3) *The special study of the groundnut with a view to its cultivation by Europeans.* — Experiments have been made by Europeans in cultivating groundnuts on a large scale. Investigations lasting several years should be carried out at the Experiment Station for the purpose of studying the type of labour-saving machinery and implements most fitted for the country, and also the cost of the different cultural methods, in order to provide the colonist with all the necessary information. To show the practical importance of such researches, it may be stated that whereas the native cultivator in the most favoured regions of Senegal only obtains in good years from 1000 to 1500 kg. of groundnuts per hectare in the United States, a crop of 3500 to 4500 kg. per hectare may be got by means of intensive cultivation.

The author next deals with the question of the *diseases and pests of Arachis hypogaea.* At Fouta-Djalon, he found the fields infested with *Alectra arachidis* A. Chev. (a *Scrophulariaceae* which is probably only a variety of *A. Senegalensis*). In Senegal, the leaves of *Arachis* are often attacked by a fungus which produces black patches on the leaflets causing them ultimately to fall. This parasite seems to flourish chiefly in wet seasons, and it is only then that the plant suffers to any extent. This disease has hitherto not been studied. In F. W. A., the chief foes of the groundnut are insects. The author studied successively the insects attacking the harvested nuts, and those infesting the growing plants. He is of opinion that a commission of experts should be appointed to study the diseases and pests of the groundnut and the best means of controlling them.

II. — The control of insect pests of the groundnut (1). — (1) *The effect of insects and drought upon the growing plant.* — The chief inju-

(1) Extract from the *Annales de Géographie*, Vol. XXVII 1818 (Note from the *Bulletin des Matières Grasses*).

ries are caused by the small termite *Eutermes parvulus* ; the attacks of these insects coincide with the drought and increase the bad effects of the latter. Dry-farming is the best method of combating drought and controlling the termite, as it renders the surface of the soil less compact. It is, however, also necessary to remove from the surface of the soil all plant remains (particularly the stalks of dried millet), in order to hinder the multiplication of the pests ; finally, early kinds of groundnut (especially the " Volete " variety) should be cultivated as much as possible in the arid parts of Senegal.

(2) *Damage done by insects to harvested groundnuts* — After the harvest, groundnuts (still in their shells) are often left piled up in enclosures where they remain in the open air for some months. They are never attacked by insects, except by a bug, *Aphanus sordidus*, which, however, does little harm. Most of the injury is done in the huge closed store-houses at the exportation centres by numerous destructive insects that attack nuts with damaged shells and, further, impart to them a disagreeable odour which depreciates the value of the oil made from the nuts and causes it to become rancid. The greatest precautions have to be taken, especially when shelled nuts are to be exported. This affords matter for much research.

(3) The author considers the *intensification of groundnut cultivation in Senegal*, and expresses the hope, that an Experiment Station will be founded for the sole purpose of studying all the biological questions connected with this plant, and that the researches will be carried on methodically and uninterruptedly under scientific, and at the same time practical, direction.

III. — Observation on the Selection of *A. hypogæa*. — Even if the Upper Senegal-Niger district alone were taken into account, it would not be wise to have only one centre of seed-production. A variety of groundnut should be well adapted to the soil and climate of the region where it is grown, and the different Sudanese varieties are very dissimilar in their botanical, agricultural, and industrial characters. An early variety suiting a district with a short rainy season would, if grown in a wet zone, give a crop inferior to that of a later kind, and would have a larger proportion of damaged seeds. A spreading variety produces a better crop on sandy soil, but does badly on heavy or stony soil, where it is difficult to extract the roots. Finally, some varieties grow vigourously on wet soil, where others wither and perish.

The author has, however, found, that, as is the case with other cultivated plants, productivity is not a varietal characteristic but is a line character. Thus the preliminary work to be done is of two kinds :

(1) The determination of the cultural types most adapted to the following conditions :

A) rainfall below 60 cm.	well-drained soil	light soil
B) rainfall between 60 and 90 cm.		heavy soil
C) rainfall above 90 cm.	damp soil	stony soil

(2) The selection of pure lines with heavy yield (answering well to the requirements of the industry) in the case of each type that is especially suited to determined natural conditions of cultivation. This work might practically be done separately. Thus, the first object might be the improvement of the product in zones where the normal rainfall varies from 60 to 90 cm. (as, for instance, in the Kaynes and Ségon region of Upper Senegal-Niger) and where the soil is well drained. To try to grow in the Niger valley between Kouroussa and Sigueré those types which had been selected for the Kayes district, would, however, be to court certain failure.

When a highly productive line suited to the cultural conditions of a given large natural region has been obtained it will be possible to induce the growers of a special centre to cultivate this type exclusively. The quality of the line will be maintained by selecting the shells for thickness, and the kernels for size, and by the growers at the chosen centre only using seed sorted by this double process, and reserving the rest of their crop for distribution at cost price at the sowing season to the groundnut cultivators of the neighbouring districts.

871 — **Four Tannin-Yielding Trees of Indo-China (especially of the Camau Region): "Cây-Duoc" "Cây-Duoc-quanh" "Vo-Duoc" and Vo-Già *(Fam. Rhizophoraceae).*** — I. POILANE. II. VERNET G. and NGUYEN DUC-LONG in the *Bulletin de l'Institut Scientifique de Saïgon*, Year II, No. 1, pp. 119-123. Saïgon, April, 1930.

I. — The promontory of Camau forms part of the Province of Bacliêu. It has a fine future before it, being a very fertile region, admirably situated (near Singapore, a free port), and watered by several large *rachs* (1) that allow of a network being formed throughout the district. The plain is, in fact, well furnished with water-ways, which are at present the sole means of communication.

The clay soil consists of recent alluvium that is still travelling seaward, so that the transported mud, which is a first very soft, is gradually arrested by the mangroves.

Hitherto, the natives have contented themselves with exploiting the forests nearest the bays, rivers and *rachs*.

The chief trees of the region (most of which are exploited) are the following:

Cay	Tram	fuel, posts, stakes.
»	Duoc	charcoal, posts, tannin.
»	Dà	Dye
»	Dà Quanh	Dye
»	Dec Tach	Little used?
»	Dec Du	Dye, posts
»	Su	Wood of first quality for all purposes.
»	Mâm	Not used.

The author only deals with Cây-Duoc and Cây-Dà, the bark of which is chiefly used for its tannin.

(1) The name given to water-courses and canals in Indo-China. (*Ed.*)

" Cây-Duoc " (*Rhizophora* sp.). — This tree reaches a height of from 25 to 30 m., its circumference varying from 2 to 3 m. It puts forth numerous adventitious roots, which start from the trunk at two or three metres from the ground, and bury themselves in the soil at distances varying in proportion to the height at which they originated. These roots, after coming in contact with the soil, have the power of giving rise to other adventitious roots, which penetrate the soil at a still greater distance. Sometimes there are also aerial roots descending from the principal branches, that is to say, from a great height. The trunk is usually straight and cylindrical, forming a shaft 15 to 20 m. high without any branches. The wood is very close-grained, the bark thick, and the leaves are oval, smooth and thick.

This tree alone furnishes about one third of the trade of the region; its wood is used for making charcoal of excellent quality as well as for posts for houses and the blades of rice hullers. It is also a good wood for fuel. The bark supplies tannin, and a dye for fishing-nets. The charcoal and bark are transported on the Cholon.

Cây-Duoc is used to such an extent by the natives, that they may be said to be systematically destroying it. It is certain, that unless some measures are quickly taken for its preservation, this very valuable tree will shortly give place to others of less importance. This destructive exploitation of " Cây-Duoc " naturally began on the banks of the streams and rivers, but even now it is necessary to go far into the interior of the country before meeting with fine specimens.

" Cây-Dâ-Quanh " (*Bruguiera* sp.). — This tree is from 8 to 10 m. high, with an average circumference of 0.30 m. The trunk is clothed with small branches, that wither as the tree grows. It grows very rapidly, attaining its industrial development in about 10 years.

The bark is used for dyeing purposes by the natives, and is therefore transported by the Sadec, Vinhlong and Cantho. At the present time, this wood is the dearest and the most-prized for local consumption. Its content is high. It is used for fishing-stakes, being considered very resistant to the action of water ; and also for fuel. The tree is exploited very wastefully by the natives who strip it of its bark while it is still standing ; they do not even trouble to take all the bark, the rest remains on the trunk, where it dries and is wasted. Further, in the majority of cases, the wood itself is spoilt, and many dead trees, in all degrees of decay are met with, which proves that this method is by no means recent. This explains why trees of little value which are never interfered with, are gradually taking the place of those that have been so barbarously destroyed. It may be reasoned that more than one third of the Cây-Dà-Quanh trees have already been killed in this manner.

II. " Vo-Duoc " (*Rhizophora* ?) and " Vo-Già " (*Bruguiera* sp.). — The information respecting these trees is of two kinds :

1) The Chinese tanners consider that drying decreases the value of Vo-Duoc bark, whereas it has no effect upon the bark of " Vo-Già " ;

hence they insist upon the former being consigned to them in a fresh conditions, though they have no objection to the latter being dried.

2) These two tannin-yielding trees are used very wastefully by the natives of the Camau district, who leave a large portion of the bark upon the tree (note what has already been said on this subject in the case of the Cây-Dà-Quanh).

The authors have investigated the statement of the Chinese tanners, and have tried to ascertain whether the natives have any industrial reasons for only exploiting the trees of such a restricted zone. They have also, begun to study the value of the wood of these two *Rhizophoraceae*.

The authors have also analysed bark samples before and after drying, in order to ascertain the effects of desiccation. In the case of Vo-Duoc bark, the loss in tannin due to resin formation was 21.24 % whereas in that of Vo-Già bark, it was only 4.09 %. The results of the analyses, therefore, proved the truth of the Chinese tanners' statement.

Messrs VERNET and NGUYEN-DUC-LONG subsequently investigated the tannin content of bark taken from different parts of Vo Duoc, and found by analyses, that it decreases from the base to the top, but that the bark of the branches is nevertheless very useful, as it contains a large amount of tannin. On the other hand, there is but little tannin in the trunk bark, though that of the twigs is tanniniferous enough to pay for extraction. The wood and bark of every part of the Vo-Già, however, is of industrial value, but the tannin content of the bark varies greatly, according to the age of the tree and the part of the tree from which the bark is taken.

RUBBER GUM AND RESIN PLANTS

872 - **The Improvement of West African Varieties of Rubber.** — VAN PELT (Head of the Rubber Service of the Institut Colonial de Marseille), in the *Bulletin des Caoutchoucs de l'Institut Colonial de Marseille*, 1920, No. 1, pp. 38. Marseilles, 1920.

The defective preparation and wilful adulteration of African rubbers has caused them to have depreciated to such an extent that some kinds can find no purchasers when offered for sale.

M. G. VAN PELT, Chief of the Rubber Service of the Marseilles Institut Colonial, who was sent on a Mission to West Africa with the co-operation of the principal commercial houses of F. W. A., has returned after spending 9 months in Guinea, Upper Senegal-Niger, and the Ivory Coast. In the course of his travels, M. VAN PELT investigated the conditions of the African rubber industry, and tried to discover how it would be possible to remedy the depreciation of the product. The conclusions arrived at by this specialist are given in his report.

It became apparent that if it were in reality a question of technique, it would be necessary to study, from a general point of view, the organisation of the country and the methods of work adopted both by the Europeans and the natives. Only in this manner would it be possible to obtain the data necessary for deciding upon the best measures to advise, and to feel assured of their feasibility.

The report is divided into the following 3 parts :

A) FRENCH GUINEA : I. *The Guinea Office* ; II *Crêping*.

B) Ivory Coast : I. *The improvement of the native products :* II. *Creping.*

C) Organisation of Production.

A) French Guinea. — (1) *The Guinea Rubber Office* : Guinea rubber is a liane rubber obtained from *Landolphia,* therefore it has naturally much tensile strength and is relatively little liable to great alteration, such as stickage. This places it in a higher class than the *Funtumia* rubber which comes chiefly from the Ivory Coast.

If, like all African rubbers, Conakry " Red Nigger " has been sold at prices considerably below that fetched by plantation rubber, it must be admitted that, far from going from bad to worse, it has been able, since the serious crisis of 1914-1915, to regain a most satisfactory position on the market, and the credit of this is due to the Guinea Office.

This Office was fortunately established in time (September 18, 1918) to permit of the application of the only means by which wild rubber could continue to compete satisfactorily with plantation rubber. It aimed at giving a guarantee that all the tested rubber exported had been thoroughly sorted, and that all the badly prepared, or adulterated portions had been removed. This practically corresponded to the use of a trade-mark ensuring the quality of the rubber sold under its auspices. Before the Office was established, the rubber was tested in a very unsatisfactory manner by the Custom House Officers.

At the Guinea Office, which works under the auspices of the Conakry Chamber of Commerce, the sorting of the rubbers is based upon individual examination of all the blocks or strips, composing the more or less compact masses sent from the purchasing factories to the port for shipment. This sorting, which necessitates the complete disaggregation of these masses, is carried out by a specially-trained native staff under the direction of a European. Any consignment that is still damp is re-dried, and only sorted when all the moisture has been removed. All blocks or strips containing impurities, or showing traces of alteration, are rejected.

The rubber passed by the Office is exported in sealed sacks. The rejected rubber may be exported by the owner, but only on condition, that he pays a fine of 5 fr. per kg., and that the bags are marked " adulterated rubber. "

It may well by supposed that the effects of such severe regulations were soon shown. In the course of the first season (1916-1917) the Office rejected as much as 25 and 30 % of some consignments ; after the second year (1917-1918), the percentage of rejected rubber rarely exceeded 15 % in the worst cases, whereas in the majority of the consignments, only from 3 to 4 % were refused. In 1918-1919, the average number of rejections exceeded 3 %.

By means of very careful collection, theoretically it would be possible to obtain a much higher standard than that required by the Office, but given the difficulties of getting workers, and the apathy and sloth of the natives, the degree of purity exacted by the Office is the highest that it is possible to obtain in practice.

The Office has clearly demonstrated the superiority of the block over the strip (1), the former being more easily tested.

(1) As is well-known, the blocks and strips are obtained by the native tapper placing upon the incision small cords of coagulated rubber. (*Ed.*)

The author thinks that the working of the Guinea Rubber Office could still be improved. For this, it would be necessary to have at Conakry a working expert technical staff in close connection with a scientific staff, such as that of the Marseilles Institut Colonial. All that then would be needed would be to collect the data obtained from the examination of the rubbers in question, which could be used in classifying the products, and form a basis for improvements in the methods of preparation.

II. — *Crêping.* — So far, only the possibilities of improving rubber by different methods of sorting, or collecting it have been considered. It now remains to be considered how to put the Guinea rubbers on the market, after freeing then by mechanical means from their impurities, that is to say after crêping (1).

In a previous paper on the subject of the crêping of African rubbers, the author principally aimed at bringing forward all the conditions required in order to ensure the maximum chance of success to this operation, should it be carried out by the importers. He then points out that crêping should not merely be a means of cleaning the rubber, but a method of creating standards for wild rubber, each type being characterised by constant properties.

With a view to determining the conditions under which it would be possible thoroughly to carry out the operations necessary for the complete crêping of Guinea rubbers, the author sets forth the results to be attained:

(1) To obtain after washing, a perfectly clean rubber retaining, after the process, the maximum of its original properties.

(2) To carry out the washing, crêping, and drying, under such conditions that a pure homogeneous standard product is obtained.

If valuable results are to be obtained from the experiment, it is necessary (the details of the operations being fixed and maintained constant) never to introduce more than one variable factor at a time (for instance : duration of washing, temperature of the water used for soaking, etc.).

(1) *Soaking.* — It is necessary to determine : (*a*) The length of time necessary to soften the masses of rubber sufficiently ; (*b*) the temperature of the water in the process : (*c*) it is also well to test the acidity of the rubber when put to soak, and to find whether the alkaline soaking water has a good effect upon the rubber by causing it to vulcanise more readily (the presence of very small amounts of acid are known to retard this process).

(2) *Washing.* — The work of the " Universal Washer " must be distinguished from that of crêpe washers. In the case of each kind of rubber, the following data are to be determined : (*a*) The content of mechanical impurities and the loss on washing; (*b*) the minimum time of washing required to remove these foreign bodies ; (*c*) the best means of counteracting any bad effects produced upon the rubber by the mechanical treatment during washing, and the conditions necessary to reduce them to a minimum.

As a regards the last point, the author states that the bad effect of crêping and washing on the tensile strength of the rubber has been greatly exaggerated. This is especially the case with mixed African rubbers, that are washed some time after coagulation, whereas the plantation crêpe coagulum from the Far East is treated while yet fresh.

The mechanical process can be controlled by carrying out vulcanising tests on samples of rubber that have been washed for a shorter or longer time. Further, by referring to

(1) See *R.*, Jan., 1920, No. 119. (*Ed.*)

previous experiments on the effect of the temperature of the soaking water, it will be seen whether it is necessary to alter this factor.

(3) *Drying.* — Three factors come into play : (1) The thickness of the crêpes ; (2) The temperature of the drying chamber (this is of special importance in the case of rubbers that are inclined to stick) ; (3) ventilation (natural or artificial).

The author describes in detail all the operations to which the rubber should be subjected in the crêping-factory, viz. (1) soaking ; (2) washing ; (3) drying.

The treatment that has been proved by experiment to be the best for a given rubber, should always be applied in exactly the same manner. It is only in this way that it will be possible to create standards for rubber.

The extent of the scientific investigations required would entail the establishment of a laboratory at Conakry, which is hardly possible ; further, even the mechanical washing cannot *at present* be carried out there, as crêping is intimately connected with preliminary laboratory work.

The author states that if Conakry were selected for the site of the crêping-factory, many of the difficulties he had anticipated prior to his voyage to Guinea with regard to its installation would be overcome, as the supply of physically pure water, motive force, and labour would then constitute no difficulty.

The climatic conditions, however, constitute a very serious difficulty, especially the fact that the year is divided into a clearly marked rainy season, and a dry season. The extreme humidity of the atmosphere during the former renders it impossible to dry the washed crêpe by natural means. Unless recourse were had to special drying-apparatus, a crêping-factory could only work under favourable conditions during the 6 months of the dry season, that is to say, from November to April. The consignments of rubber arriving during this time would have to be stored until work was resumed or else shipped to Europe without the treatment the other rubbers receive.

The author has studied the question of the machinery and staff necessary for installing a crêping-factory in Africa.

Taking into account the fact that work can only be done during 6 months of the year, and at the rate of 25 working days per month, i. e., a total of 150 days, a factory with 1000 tons of rubber to crêpe (a quantity which the writer states is the average annual production of the Colony) would need plant capable of treating 6 ½ tons a day : 7 sets of machines, each consisting of 1 universal washer and 2 crêping-washers.

Another arrangement, which would obviate the use of so much plant, would be to work the factory continuously throughout the dry season, by employing 3 gangs of workers on 8 hour shifts. Under these circumstances, a factory with 3 sets of apparatus would suffice. As, however, the native staff requires constant supervision, this would entail doubling the European staff.

Seeing that the natives have to be taught their work and cannot be depended upon, the author considers that it is not advisable to carry on

the work only during the dry season and that it would be better to consider the question of installing an artificial drying-plant that would allow of operations being continued during the whole year.

All things considered it would be best, then, if the importers themselves carry out the crêping. During the time that must elapse before the operation, the scientific laboratory and the factory should be installed in Europe Later on, when all the woking details are established and the special Staff formed, the whole plant could, if it appeared ecomically advisable, be transported to Conakry, where the rubber would be concentrated

After examining the circumstances in which it would be possible for the importers to undertake the crêping, the author considers that they would have every chance of success in starting this autonomous industry.

They would in fact find themselves in such a situation that, as regards the mechanical cleaning of rubber, they would obtain results far superior to those obtained by manufacturers in their factories.

B) Ivory Coast. — Most of the rubber in the Ivory Coast is obtained from *Funtumia*, and though there are also large quantities of the liane, *Landolphia*, similar to that yielding the Guinea rubbers, tree rubber has always taken the first place.

Funtumia rubber is inferior to that from *Landolphia*, and has less tensile strength ; a block of the former offers more resistance to stretching than a similar piece of the latter) ; its resin content is high (it may amount to from 7 to 15 %), thus needing more sulphur in vulcanising ; and it has a great tendency to stick.

Plantation rubbers caused a considerable fall in the prices of *Funtumia* rubber which reached the market in a bad condition, owing to the presence of impurities, to stickiness and intentional adulteration. So much had it depreciated that at times no purchaser can be found for the consignments.

Rubber is no longer allowed to be made up in " lump " as formerly, but has to be formed into thin blocks, or " biscuits " ; this tends to hinder fraud, but it cannot affect the sticky alteration that takes place in the rubber itself.

It was formerly supposed that the stickiness was due to microbiological action, but more recent investigations would seem to show that the alteration is caused by depolymerisation followed by the oxidation of the rubber. Before starting on his mission, however, the author had examined, at the Marseilles docks, many samples of *Funtumia* rubber from the Ivory Coast, and had found that the sticky zones seemed to be formed around imperfectly dried pockets from which the uncoagulated serum and latex had not been able to exude. This observation suggested a line of work for the experiments that he intended to make during his voyage.

In the case of he Ivory Coast, just as in that of Guinea, it was a question of directly improving the quality of the rubber by changing the methods of preparation, and of subsequently seeing whether it would be

possible and desirable to undertake the mechanical purification of the rubbers of the Colony.

I. — *The improvement of the native methods of preparation.* — It has been seen that it was the direct intervention of the trade, by means of the Rubber Office, that saved the situation, as far as the rubbers of Guinea were concerned. No such Office exists on the Ivory Coast, though it is greatly needed on account of the very bad quality of the rubber. The only measures that have been taken are: (1) The enforcement of a decree prohibiting the preparation or sale of rubber in any other form than that of "biscuits"; (2) the enforced inspection by the Custom Officers, assisted by a dealer, of all consignments of rubber on their arrival at the port of exportation. These measures proved wholly insufficient, the inspection being a mere formality, and carried out in a perfunctory manner.

The author is, however, at pains to prove that certain measures might be taken which would ensure an improvement in the Ivory Coast rubbers. Some of these have to do directly with the preparation, while the others are of a general nature.

The Ivory Coast natives coagulate the latex with boiling water, and as M. VAN PELT had come to the conclusion that no better method could be devised, he devoted his attention to improving it to the utmost, in order to obtain rubber of the best possible quality. Experiments made at the Bingerville laboratory led to the following conclusions:

(1) The volume of boiling water should be at least 4 times as large as that of the latex to be coagulated.

(2) A large number of portions of latex ought not to be successively coagulated in the same boiling water, as the accumulation of serum due to each of the previous operations greatly decreases the coagulating power of the water. The coagulum obtained from water containing a large amount of serum, is dark and is less easily stretched.

(3) The bad effects of an excessive amount of serum and water, both as regards the colour and keeping qualities of the rubber, showed that it was necessary to make the coagulum into biscuits containing as little serum and moisture as possible. This can be done by the help of a small hand cutting and stretching machine.

II. *Crêping.* — Theoretically, the need for crêping this rubber is disputable for, as *Funtumia* is a tree, its latex can be extracted in a sufficiently clean, pure condition. In practice, however, crêping is indispensable, as when the natives work alone and without any competent control, the results of their labours leave much to be desired.

The author thinks that as the climate of the Ivory Coast is even more damp than that of Conakry, any factory set up there would have to be provided with artificial drying-plant, for a factory only working during the dry season is quite out of the question.

It is necessary to begin by setting up such a factory in Europe; if, after the crêping is working properly and the results of the operation have been tested industrially, it is found that the return is sufficient to warrant the expense entailed in transporting the plant to the Colony, this could

then be done, and the whole factory might be removed to the place where the rubber is collected for shipment.

C) *Organisation of production.* — The mistakes that have been made with regard to African rubbers should serve as a warning that ought not to be disregarded in the case of the other products of West Africa. When rubber was selling at a very high price (15 to 20 fr. per kg.), no trouble was taken in its production, as no matter how inferior its quality might be, it was sure to find a purchaser.

The natives and dealers, who were often unscrupulous, cared only for the present gain, and gave no thought to the future. Is was only when large supplies of rubber reached the market, that any trouble was taken to improve the quality of the product, and it was hoped that this would be effected by the help of administrative measures. Unfortunately, everywhere, and in West Africa in particular, there is a great difference between making a decree and having it carried out. This is a commercial matter, and those interested must follow in the steps of the Guinea Office.

The author draws attention to the neglect from which other French West African products are suffering (palm-oil for instance) and states that no time should be lost in trying to improve them as much as possible. The organisation and development of production are the only means by which so-called savage countries can be made more civilised. What is required is an understanding between the traders. The commercial companies must see that their produce, rubber, etc., is properly prepared; they need competent experts and of common accord and at their joint expense, they should provide a complete technical research organisation.

It must, however, be well understood that the suggested improvement and increasing of the rubber production by means of changes in the native methods are only temporary expedients, and the real object is the introduction of systematically worked, regular plantations.

The plantation system has proved so satifactory in the East that it might be advisable, even now, to make plantations of latex-yielding trees in West Africa. This does not apply to other trees the systematic cultivation of which is still on trial in other countries.

The idea of making plantations at once raises the question of labour in Africa. By the use of machines, however, this could be supplemented to a certain extent, and on the other hand, the natives could easily be attracted to the plantations by providing them with confortable dwellings, good food crops, and hospitals, etc. For these very reasons, the sanitary condition of both the European and native staffs is, as a rule, better in the Eastern Colonies than it is in Africa.

The author is convinced that the moment has come for the large African companies to take these steps. It was for the very purpose of finding a solution to the difficulties set forth above, that two of the most important of these companies the Compagnie Française de l'Afrique Occidentale, and the Compagnie commerciale de l'Ouest Africain, entrusted to the author the mission which he carried out under the auspices of the Colonial Institute of Marseilles and of which he now renders account.

873 – **Coconut Milk, it is Characters, Composition and Uses.** — LAHILLE, A., in the *Bulletin économique de l'Indochine*, Year XXIII, New Series, No. 140, pp.125, figs. 1, diagrams 4. Hanoï-Haïphong, Jan. Feb. 1920.

Much has been written about the coco palm (*Cocos nucifera* Linn.); certain parts if its fruit, such as copra, have been the subject of careful study, and used in many different ways. The milk found in the cavity of the nut is certainly one of the products that has been least analysed, and therefore very little is known of the details of its composition. Wherever the coco-nut palm grows, however, the inhabitants make great use of the milk.

The author principally deals with the coconuts of Cochin-China, where there are 4 chief varieties of *Cocos nucifera*: those known as "Bi" and "Ta" yield much copra, but little is obtained from the "Luà" variety, and still less from the "Xiêm".

The nuts of the first two kinds are almost exclusively used for their milk, which is taken fresh. The "Bi" variety of coco palm bears large fruits, and is already intensively cultivated in a good number of plantations. The third variety is most grown in the provinces of Gia-dinh, Mytho and Bentré. The Xiêm variety is rather common in the provinces of Gia-dinh, Mytho, Bentré and Thudaumot. The author mentions a certain number of analyses made previously by different investigators, but the results were very incomplete and inaccurate. The new experiments required were carried out at the chemical laboratory of the Pasteur Institute at Saïgon, and the author, gives a detailed account of chemical investigation of coconut milk, which varies greatly according to the variety, the age, and the region where the tree grows, as well as according to the season, the degree of ripeness attained by the fruit, etc.

The author only devoted his attention from a practical and utilitarian standpoint to the milk of the fully-developed and unripe nuts of the Xiêm and Lira varieties, and to that of nuts with ripe copra.

1) *The coconut milk from fully-developed and unripe fruits of the Xiêm and Luà varieties.* — The average amount of directly reducing sugars (levulose, glucose) present per litre of the milk of these nuts, may be reckoned at from 50 to 55 gm. There are usually about 3.5 to 5.5 gm. of salts, consisting, for the most part, of potassium salts, sodium chloride, lime, and phosphates.

When the milk is required for drinking, it is best to select green nuts which are quite developed and have their cavity as full as possible. As the nut ripens, the milk becomes poorer in sugars, and the salts content increases, so that it is no longer a pleasant drink, and does not quench thirst. Further, if the salt taste is too pronounced, it may have other disadvantages. If good nuts are selected, and this only requires a little practice, the milk when taken in moderation is a wholesome, pleasant drink for tropical countries, costing little or nothing, and saves the use of other food. The coconut provides travellers in the bush with excellent food, and its milk affords a refreshing beverage to town-dwellers.

2) *The milk of ripe plantation coconuts.* — Copra-yielding nuts, while still green, give, like the other varieties mentioned, milk of the first quality, but as they are grown for their copra, they cannot be gathered till they are ripe. At this time, as is shown by the author's analyses, the amount of sugar falls to 20 gm. per litre, the numeral content rises to from 5 to 6 gm., and the proportion of nitrogen compounds also slightly increases. The author advises feeding this milk to stock; if used for this purpose, it must be collected in a cleanly manner and given to the animals a few hours after the nuts are opened. The coconut milk can be added to the animals drinking-water; experiments in this connection are being carried out by M. GIRARD.

The author urges the planter not to waste coconut milk, even if only on account of the potassium salts it contains. It it is not intended for the use of stock, it can be collected in vessels, and before, or after fermentation, a little slaked lime, or phosphate of lime, can be added, so as to form a mixture to be used as a manure for heveas or coconut palms.

The adulteration of cows' milk with coconut milk. — This is done more frequently than is supposed, but the fraud is easily detected by means of chemical and microscopic analysis, in the way described by the author in his article.

Coconut milk used in medicine. — From its composition, coconut milk has therapeutic properties, and is a true vegetable serum, as well as an ordinary beverage. Very interesting experiments have been made, at the Saïgon hospital, upon patients suffering from beri-beri, neurasthenia, malarial anaemia, pneumonic influenza, etc. The experiments will be resumed, but so far it can be stated that:

(1) Coconut milk taken in moderation, that is to say, to a maximum of 500 gm. daily, is not poisonous; green, fully-developed, but unripe nuts must be chosen.

(2) Coconut milk has undoubtedly diuretic properties, and seems to have a beneficial effect upon many acute, or chronic, cases if the kidneys are not obstructed.

In short, in the colonies, at great distances from well-supplied and equipped hospitals, coconut milk is most useful, as it is a medicinal solution which is easy to procure, sterile, cheap, and efficient. When removed from the nut, filtered, and sterilised in an autoclave, it will keep a long time.

Coagulation of rubber latex. — In some newspaper articles, coconut milk has been recommended as a coagulant for latex. The author has made some experiments on this subject, using 4 cc. and 6 cc. of coconut milk to 100 cc. of latex; at the end of 48 hours, however, coagulation was still incomplete and the latex was of a brown colour. With age, and in contact with air, coconut milk becomes acid, thus if the acid content at the time the fruit is opened, is 0.37 gm. per litre, it will have increased, after 11 days, to 8.88 gm. If it were used at this time, it might after

being clarified, act as a good coagulant for latex. But if the process depends upon the action of the acids, pure acetic acid, which can easily be added in the amount required, is preferable.

874 – **A Contribution to the Study of the Citronellas.** — SCHAEFFER, in *L'Agronomie Colonial, Bulletin mensuel du Jardin Colonial*, New Series, Year, IV, No. 27, pp. 65-73; No. 28, pp. 114-118, No. 29, p. 168-169; No. 30, pp. 192-208, figs, photographs. Paris, 1919-1920.

The citronellas belong to the genus *Cymbopogon* of the family Gramineae, and are plants that yield essential oils. According to Dr. P. STAPF (1), the genus includes:

(1) "Palmarosa": *C. Martini* Stapf. var. *Motia* = *Andropogon Martini* Roxb.

(2) "Ginger Grass": *C. Martini* Stapf var. *Sofia* = *A. Martini* Roxb,

(3) "Lemon Grass": *C. citratus* Stapf. = *A. citratus* D. C.
C. flexuosus Stapf
C. pendulus Spapf.
C. coloratus Stapf.

(4) "Citronella": *C. Nardus* Rendle var. *Linnaei* (*typicus*) Stapf.
C. Nardus Rendle var. *confertiflorus* Stapf.
C. Nardus Rendle var. "Lena-batu"
C. Winterianus Jowitt, "Maha-pengiri".

The author studies these different varieties successively. The cultivated citronellas are *C. Winterianus* Jowitt, or, "Maha-pengiri" and *C. Nardus* Rendle, or "Lena-batu".

He also studied the citronella in Ceylon and in Java from the standpoint of cultivation, uses, and trade. By distillation, oil of citronella is obtained, this consists of geraniol and citronnellal, which are employed in perfumery and soap-making, chiefly on account of the strong rose scent of the geraniol. After distillation, the citronella stalks are used as fuel in steam-generators, and can also be made into paper.

The cultivation of citronella is much to be recommended on account of the growing demand for geraniol, and the many ways in which citronella oil is employed. The best variety to grow is "Maha-pengiri", as the oil it yields is of superior quality. This plant requires a very hot, damp climate, and a rich soil. The cultivator must have plenty of labour at his disposal if a paying cropisto be obtained.

The French colonies, thanks to protective duties (which amount to an actual bonus of 1 fr. per kg.), could cultivate citronella to great advantage for the purpose of supplying the Paris market with essential oil.

(1) *Kew Bulletin*, No. 8, 1906, pp. 302-364, The Oil Grasses of India and Ceylon. (*Ed.*)

875 - **The Colas of Indo-China.** — VERNET, G., NGUYEN-VAN-LIENG and NGUYEN-DUC-LONG, in the *Bulletin agricole de l'Institut scientifique de Saïgon*, Year II, No. 5, pp. 151-156. Saïgon, May 1920.

The variety grown in Indo-China is *Cola nitida mixta*, for it has only 2 cotyledons, and its seeds are red, white or of various intermediate shades (1).

Different Indo-Chinese Agricultural Stations have possessed some of these trees for a long time, but as they are few in number, they have hitherto only been used as a source of seed, or cuttings when required. Planters have naturally hesitated to cultivate the plant on a large scale, as it has no certain future before it.

There are, so far, no regular Cola plantations in the country, though on many concessions there are sufficient trees for the fruit to serve as a basis of a certain amount of trade.

All soils do not appear to be equally well-suited to *C. nitida ;* thus, at the Honghiem Experiment Station, the average yield in 1916 was only 6.45 kg. fresh nuts per tree, although their caffeine content was very good.

Some of these trees exist at Suõi-Giao, in the plantations belonging to the Pasteur Institute, but their yield has always proved extremely irregular, and whereas certain of them have borne large crops, others are completely sterile. Some trees that fruited regularly hitherto, now produce much less, owing to their having been gradually buried in the midst of a hevea plantation, where the thick shade prevents the fruit ripening.

If, however, the crops at these two Stations are unsatisfactory, this is not the case everywhere in Indo-China, especially on certain red soils of Cochin-China. In fact, M. GIRARD planted 11 cola trees on his concession at Suzannah in 1913 ; they are now 7 years old, and although all the crop has not yet been gathered, they produced between November, 1919, and March, 1920, 418 kg. of fresh nuts, i. e., 38 kg. per tree.

The authors deal solely with nuts from the Suzannah Station (2) supplied by M. GIRARD.

The size of the fruit and the nuts is very variable. It can be said that, as a rule, the fruits that ripen first, and those gathered at the height of the season, are finer and contain larger kernels than the late ones. Generally speaking, the finest fruits have the largest kernels. Sometimes, owing to the abortion of some of the ovaries, each fruit has very few kern-

(1) In his article " Etude sur les kolatiers du jardin économique de Singapore " M. E. MATHIEU writes in *The Gardens Bulletin of the Straits Settlement*, Nov. 11, 1918 : " *Cola nitida* includes those trees having only 2 cotyledons and *Cola acuminata* those with more than 2 cotyledons. The kernels or " nuts " of the cotyledons trees are considered the best ; the natives of West Africa (who are great consumers of cola nuts), prefer them to those borne by trees with more than 2 cotyledons ."

3 varieties of *Cola nitida* are known, viz., (1) *C. nitida alba* with white kernels ; (2) *C. nitida rubra* with red kernels ; (3) *C. nitida mixta* which both white and red kernels. (*Ed*).

(2) Mention has already been made in the *Review* of the fine hevea plantation at Suzannah. See *R.*, Feb., 1919, No. 205 and Jan., 1920, No. 50. (*Ed.*)

els, but these grow to a great size, and are larger than the finest usually produced.

The greatest variations observed by the authors in the weight of the seeds was between 8.2 and 43.3 gm. in the case of fresh specimens, whereas the weight of the fruits varied between 256 and 631 gm.

The white pulp surrounding the seeds contains nearly 9 % of sugar, from which by fermentation, about 4 % of absolute alcohol can be obtained.

Hitherto, the cola nuts are the only part of the fruits regularly used, e. g., in medicine in the preparation of different extracts and wine. In the country where they grow, they are much eaten by the natives, and they enter into the preparation of different European food products, after being mixed with sugar, chocolate, various kinds of flour, etc.

In the manufacture of alcoholic extracts, the dry powdered seeds are extracted with 60 % alcohol, and the extract thus obtained is concentrated until one litre of the solution contains an amount of extracted matter corresponding to 1 kg. of dried seeds, or in other words, until this alcohol contains 12.5 % of dry extract (Codex 1918, and Dr. BRISSEMORETS' formula).

When fresh fruit is used containing 40 to 50 % of moisture, more highly concentrated alcohol may be added ; in such a case, the authors used 75 % alcohol.

The following two analyses will give an idea of the high content of cola nuts from Cochin-China :

Analysis No. 2303.

1) Matter extracted in a Soxhlet in 75° alcohol	15.34 %	of dry nuts
Ash of extract	0.32	»
2) Matter extracted in a Soxhlet in 75° alcohol	13.11	»
Ash of extract	0.27	»

Analysis No. 2306.

Moisture % of raw material, dried		0.850 %
Nitrogen 1.182 %, expressed as albuminoids		7.387
Glucose		1.189
Saccharose		0.277
Starch		70.670
Cellulose		2.333
Tannin		7.907
Ash	P_2O_5	0.345
	Fe_2O_3	0.030
	Mg O	0.380
	Ca O	0.296
	K_2O	2.181
	SiO_2 and not estimated	0.108
Caffeine		1.927
Theobromine		traces
Colouring matters and not estimated		4.120
		100.000

In the same fruit, sometimes the dark seeds, and sometimes the lighter ones, are the richer in alkaloid, so that, there is no correlation between the colour of the seed and its caffeine content.

Cochin-China cola nuts have a very good average caffeine content, and the authors found that it varied from 1.19 to 2.39 % of the dry nut, whereas the powdered nut of commerce contains from 1.25 to 2.2 %.

With a view to the utilisation of the nuts grown in Indo-China, the authors suggest that the concentrated alcoholic extract should be made on the spot, instead of sending the dried fruit (which may become mouldy on the voyage) to Europe. In this way, products with a finer flavour would be obtained.

According to the researches of GORIS and ARNAULD, a portion of the caffeine is combined with the red colouring matter of the cola nut, and this organic salt splits up progressively in the organism. To this peculiarity is due the prolonged action of caffeine when used in this form.

Messrs GORIS and ARNAULD have also shown that this organic salt disintegrates gradually during the drying of the cola nut under the influence of a special diastase that is present. It was for the purpose of preventing the disintegration that the idea was entertained of destroying this diastase before the nuts were dried, so as to preserve all the original value of the product. They advised that the nuts should be exposed in an autoclave for some minutes to the action of a temperature of 105°C, or else immersed for a few minutes in boiling 90 % alcohol. These investigators also prepared their "intraits" (1) of cola by treating the freshly-ground nut with 90 % boiling alcohol.

876 – **"Tam Thât" (*Panax repens* (?)) a Medicinal Plant Serving as a Substitute for Ginseng.** — CREVOST, Ch. in the *Bulletin économique de l'Indochine* Year XXIII, New Series, No. 140, pp. 107-110. Hanoï-Haïphong, Jan.-Feb,, 1920.

Tam-Thât should be very carefully examined in order to settle its botanical identity, many different opinions having been held on the subject. It appears that the plant has been correctly determined as *Panax repens* Max., an *Araliaceae* of the same order as ginseng.

Its rhizomes yield a medicinal substance said to be the nearest substitute for true ginseng (*Panax Ginseng* Ness.), which has a wide-spread reputation as a tonic stimulant and aphrodisiac, which builds up the strength of convalescents, and especially of women after childbirth.

The author deals with the cultivation of "Tam-Thât", and the trade in its rhizomes. He has reached the following conclusions :—

Being a long-lived plant, it cannot be grown in high latitudes as easily as an annual like the opium poppy ; for this reason, it can only be cultivated by well-to-do persons, and would not suit most of the mountain peasants. Nevertheless, it would be worth while cultivating it more intensively in those high districts where it has already established itself to some extent, and substituting it in a considerable measure for the

(1) "Intraits" are solutions containing vegetable principles in the same chemical condition as those found in the living plant. (*Author's note*)

poppy. This has been done to a certain degree in Yunnan, so that there is nothing to prevent the same course being adopted in Tonking. The product, like ginseng, is a panacea and not a drug for the cure of any specified disease, but no doubt, it would be used in Europe. Even if it found no market there, howevever, its intensive cultivation in Tonking would still be advisable, the only disadvantage to be foreseen being a possible fall in the price of the rhizomes, but this is a fate that awaits many other crops.

877 – **The "Primativo di Gioia" (Early Gioia) Vine.** — Musci, G. and Sannino, J. A., in the *Rivista di Ampelografia* Year I, No. 2, pp. 1-5, figs 1. Alba-Livorno, January 15, 1920; No. 3, pp. 36-37, February 1, 1920; No. 4, pp. 49-51, February, 1920. VINE GROWING

Prof. Sannino gives an exhaustive summary of the monograph written by Prof. G. Musci (Royal Technical Delegate, Director of the Bari Consortium for the Protection of Vine-Growing); and appends some short observations.

"Primativo di Gioia" is a vat grape which appears on the Italian market during the last 10 days of August. This vine, which is also known simply as "Primativo". or "Primaticcio", belongs to the hilly zone of the districts of Gioia del Colle and Santeramo, which is composed of the spurs of the Murge, the lower slopes losing themselves in the rich alluvial plain of the Matine. On these hills, which rise from 400 to 500 metres above sea-level, it finds the most favourable conditions of growth, for the number of calories necessary for ripening its fruit is considerably less than that required by the other varieties cultivated in Apulia.

"Primativo" grapes are largely imported into France, where the must is mixed with that obtained from local grapes, because it imparts to the wine a bouquet much resembling the flavour of certain French wines.

Nothing is known of the origin of this vine, but some persons have regarded it as a degenerate Burgundy Pinot, and others have identified it with the Cesanese vine, but Sannino has pointed out that there is a great difference between the leaves of these 3 vines. As Pulliat observes, in "*Mille variétés de Vignes*", the Gioia "Primativo" much resembles a black Piedmontese "Dolcetto". The researches of Musci have revealed that towards the end of the XVIII century, a vine was selected at Gioia del Colle which was more adapted than the others to red soils ("terre rosse") (1) and should produce early abundant, and

(1) This earth is rich in hydrated sesquioxide of iron mixed with varying proportions of clay and at times silica, but rarely lime. It is formed beneath the upper layer of soil and is derived from the disintegration of the compact limestone on the subsoil. Although this red earth is sometimes more then 80 cm. thick, it is often much less, and occasionally thins out altogether, in which case, the compact calcareous rock of the subsoil in exposed. The limestone is traversed by conchoidal fractures in some places; the strata are usually 1 m. thick, and are either horizontal, or slightly inclined. Occasionally, intercalary beds of a few centimetres thick occur, but as a rule, the rock is uniform, showing no signs of stratification. This red earth belongs to the cretaceous, and as has been shown by De Giorgio it corresponds to the "terra rossa" of Frioul, the Carso, and Albania. From the lithological and stra-

excellent grapes. It is owing to its early ripening that this vine was named " Primativo ". From Gioia de Colle, it spread throughout Apulia, and was grown a little in Basilicata. If its identify with Dolcetto can be proved, the " Primativo " variety is the vine most cultivated in Italy.

The Gioia " Primativo " has the following chief ampelographical characters :—

Stock rather vigorous ; habit upright.

Shoots of average length and diameter; internodes short, striated, and wine-coloured, the tint becoming darker near the nodes. The latter are regular, and bear average-sized, prominent, spherical buds ; tendrils few and bifid.

Buds downy, green, and bordered with red.

Adult leaf of average size " five-lobed, upper surface rather bright green, not glossy, smooth, flat, supple and glabrous ; the lower surface is pale green, rugose, and covered with thick down ; petiolar sinus deep, rounded, forming a V. Dentation consisting of one series of irregular, slightly-bent, unequal, sharp teeth. Veins raised, inclining to red in the centre, tomentose on the lower surface.

Petiole $^3/_4$ length of median vein, thin, thickening at base, grooved throughout its length, tinged with red, forms a right angle with the lamina. In autumn, there are red patches on the leaves ; the latter fall early.

Bunch of average size, cylindrical with long wings. Stalk green, penduncle short, slender, herbaceous, woody at base, pedicels short, average, green ; brush of average size, white. Grapes usually small, round and dark-blue, with thin, glossy, delicate skins, rot easily. For this reason, grape-sellers knowing that " Primativo " does not carry well, send the pressed grapes in tanks or barrels.

Pulp. Soft, fleshy, very ripe, with very sugary juice, a pleasant vinous flavour and characteristic aroma.

Pips nearly always 2 in number of medium size, long, brown.

" Primativo " is a vine that shoots late, and is therefore little exposed to spring frosts. It buds during the first ten days of April in the Province of Lecce, from April 10 to 20 at Conversano, etc., and not until the end of April or the beginning of May in the hills of Gioia, Santeramo, etc. It is fairly resistant to chlorosis, fairly immune from fungous diseases, but very susceptible to prolonged drought.

In Piedmont, " Dolcetto " buds equally late and also suffers from long drought.

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tigraphical standpoint, it is analogous to the " bolo rosso " of Basilicata, and to the " bolo " covering the mountains of Gargano, the hills of Fasano, Ostuni, Cisternino, Locorotondo Martina Franca, Ceglie Messapica, and those of Conversano, Castellana, Putignano, Noci, Alberobello, and the Murge of Canosa, Minervino, Spinazzola, Gravina, Altamura, Santerano, Gioia, Cassano and the Serre of Galatone and Alesano. (*Author*)

Regarding *terre rosse* and other soils of Apulia, see *R.*, May, 1919, No. 560 ; July-Sept., 1919, No. 822 ; February, 1920, Nos. 293 and 304. (*Ed.*)

In Apulia, " Primativo " flowers late ; it is much affected by bad weather conditions, so that its crop there is uncertain. Cold wet springs do much harm to vines planted in deep soil which also suffer considerably in rainy damp autumns and winters. MUSCI advises bleeding, annular incision, and the application of sulphur during the flowering season, to prevent the flowers falling, and to promote the setting of the fruit. When the flowers do not fall, " Primativo " fruits abundantly. In Piedmont, " Dolcetto " is not subject to its flowers falling.

The " Primativo " grapes ripen very early : — During the last ten days of August and the first days of September along the Adriatic coast and on the Salentine peninsula ; from September 10 to 20 at Conversano, etc., and from September 20 to October 1 on the hills of Gioia, Alberobello, etc., according to the date of budding.

As the skin of this grape is delicate, it gets scorched by the sun in very hot seasons. On shallow soils (Mola, Polignano, and Monopoli) the grapes wither before they become completely ripe.

This can, however, be prevented by two extra hoeings carried out ten days before the ripening of the grapes.

The early maturity of " Primativo " is of great importance, especially in high districts where other varieties do not ripen till about the middle of October, when heavy continuous rain falls which rots the grapes, or the green berries are destroyed by the autumn frosts. " Primativo " ripens at the same time as Dolcetto and Pinot noir, which is the first period according to PULLIAT.

" Primativo " is characterised by the productivity of its side-shoots, which bear the small bunches called " racemi " by M. MUSCI. These contain more grapes than ordinary bunches when the vines are thinned, or topping before the flowering season causes the development of shoots bearing many of these bunches. In Apulia, these grapes ripen and yield a light red wine, rich in acids. M. MUSCI advises the removal of these shoot-bunches, if ordinary blending wines are required, and for this reason it is better not to top the vines.

The wine made from " Primativo " grapes is of a violet-red colour and has a vinous smell. It is difficult to make it in the hot zone of the Apulia coast, on account of the high temperature of alcoholic fermentation which produces sweet wines that do not keep well. In the cooler hill districts, " Primativo " furnishes a table wine especially if its grapes are mixed with white grapes. In Apulia , wine from the " Primativo " vines can be aged, and when very old it assumes a yellow amber colour like that of Marsala.

According to the data collected by the " R. Cantina sperimentale " at Barletta, the average sugar content of " Primativo " must is 20.65 % ; average acidity is 5.80 ‰ ; the average must yield is 74.23 kg. or 63.37 litres per 100 kg. of grapes ; the alcohol content varies from 11 to 12.6 % for grapes growing in the cooler districts, to 13-15 % and, in exceptional cases, to over 17 % for those cultivated in warm districts ; the former are

used in the manufacture of table wines, and the latter for blending-wines.

« Primativo " can be successfully grafted on the chief phylloxera-resistant varieties, as has been proved by the Directors of the Apulia Antiphylloxera Consortiums during trials lasting 15 years.

In the " Primativo " zone, the most commonly cultivated stock is Rupestris 3309, which is resistant to drought ; number of successful grafts 96 % ; growth vigorous, yield high. When Primativo is grafted on Riparia gloire and Riparia grand glabre 90 % of the operations performed in the vineyard are successful and 60-50 % of those carried out in the nursery, whereas in temperate or cold districts, the contrary is the result, especially if any forcing is used.

In Apulia, the wood of the scion on the Riparia stock grows very thick, which is a disadvantage in the case of vines without props, as they easily break off at the point of union. For this reason, Musci advises that the point of the graft should be placed some centimetres beneath the soil, and that the roots growing on the scion should be removed during digging operations.

" Primativo ", when grafted on Riparia, needs deep moist soil (" lame ") ; if the ground is too dry the graft grows little and the difference between the diameter of the stock and of the scion becomes still more accentuated.

Berlandieri Riparia 420 A is undoubtedly an excellent stock for " Primativo ". It grow vigorously in sandy clay or marl, even with a rocky subsoil, provided there are numerous crevices in the latter. Under such conditions, it proves very resistant to drought and excessive heat, its yield is regular and constant, and the grapes ripen early. During the first few years, the scion grows but little, but after the 4th or 5th year, it becomes luxuriant ; 70-80 % of the grafts made in the nursery are successful, and 90 % of those executed in the vineyard. On Berliandieri × Riparia 157-11, " Primativo " does very badly in shallow rocky soils, but succeeds marvellously on sandy clays or clay loams even if they are heavy, and also in very calcareous soils. The percentage of successful grafts rarely reaches 70 %.

When grafted on Berlandieri × Riparia 34, it the soil is deep and damp, " Primativo " is more vigorous and productive than when grafted on 420 A and 157-11, even on soil containing 60 % of carbonate of lime.

On Aramon × Rupestris Ganzin No. 1, " Primativo " does splendidly on account of its affinity to the former vine, which is also proved by its complete union on deep, moist clay loam soils with a calcareous marl subsoil very rich in carbonate of lime. The only defect of Aramon × Rupestris is that it has little affinity to " Primativo " and the Apulian vines, with the exception of " Turchiesca ", especially when the grafting is done in the vineyard. Musci is of opinion that this difficulty could be overcome by flute grafting, which has proved successful in 92 % of the cases. Aramon × Rupestris does not flourish in deep moist, rich soils, in which the " Primativo " grafts are inclined to set badly.

Mourvèdre × Rupestris 1202 which has been given up by the Sicilians on account of its lack of affinity to the local vines, is however an excellent stock for " Primativo ".

Grafted on Rupestris du Lot, " Primativo " grows extremely vigorously but rich damp soils must be avoided, as these always cause the flowers to fall. In Apulia, Rupestris du Lot prefers rocky ground with many crevices which allow the roots to penetrate deep. The scion grows fairly strongly there, and produces early grapes. On the other hand, on shallow soils, the growth decreases after the first few years, and on sandy soils, the vine suffers from drought.

Musci mentions the facility with which this stock is attacked by bramble-leaf (*roncet*), while grafts 8 or 10 years old become rachitic and weak, even if planted in suitable soil.

Rupestris metallica grafted with " Primativo " behaves in the same way as Aramon × Rupestris No. 1. The graft rarely succeeds, as is the case with the other black Apulian varieties.

" Primativo " grafted on the hybrids Rupestris × Berlandieri 301 and 219 A, and on Berlandieri × Rupestris 17-37, grows rather slowly at first, but becomes very vigorous after 3-4 years, it is always very fruitful, the grapes ripen early, and the vine is very resistant to drought. 301 A is a more productive and stronger stock than A 219, but the latter is, on the other hand, more resistant to drought and excessive heat. 17-37 is superior to both the others, especially on the shallow, rocky soils of the Murge chain.

Riparia Cordifolia × Rupestris 106-8 was abandoned without reason, for Musci's experiments in growing it on shallow sandy clay or clay loam soils proved it to be an excellent stock, the grafted vines being very strong and productive.

878 – **Hybrid Vines for Table Grapes.** — Pée Laby, in *La vie agricole et rurale*, Year 9, No. 19, pp. 325-327, Paris, May 5, 1920.

The following is a list of the vines which the author thinks produce the best table grapes.

First of all comes *Seibel* 5279, surnamed *Aurore*, because its fruit ripens very early about 15 days before Chasselas. The bunches, of an average weight of 150 gm., are composed of grapes about 16 mm. in size ; their skins are of a fine golden colour, they are very juicy, sweet, and have a pleasant aroma When ripe, however, their pulp is not firm and this, together with the thinness of their skins, renders them unsuitable for exports. They have many good qualities to compensate for this one defect. No. 5279 is immune to mildew and oidium. In 1915 and 1917, without any copper treatment, they resisted all fungoid diseases.

This vine is also very vigorous, it grows on its own roots in good soils, and adapts itself well to the various stocks in general use. It is said to be a little susceptible to time but this, however, the author has had no opportunity to test.

It is very productive, bearing 3 or 4 bunches on each side-shoot. It buds in the second period.

The wine remains sweet for a long time, it lacks the acidity necessary for normal fermentation, and could therefore be used in making dessert wines.

Seibel 5279 thus produces excellent table-grapes, but they have to be consumed where they are grown.

Seibel No. 2653 bears such attractive golden grapes that they are known under the name of *Flot d'or*. Unlike those of *Seibel* 5279, they are firm, though equally sweet, a little larger and slightly ovoid in shape. They ripen late in the first period.

The chief defect of this hybrid is that it is apt to *millerander* in too damp places. In a well drained soil, and with age, this trouble can be overcome.

It is very easily protected from disease, since 2 sulphatings are ample; it is almost immune to oidium. All it needs is one good application of sulphur at the right time. This hybrid can well be used in place of Chasselas.

Seibel No. 3013 is as susceptible to mildew as Chasselas, and must be treated as frequently. Its grapes are, however, finer.

Girerd 157. The author only recommends this hybrid for the production of table grapes if no better can be found, for it is very susceptible to fungoid disease. Its grapes have, however, been used for the table on many occasions, especially, in 1919, when the Chasselas were destroyed by mildew. When grown on rather dry soils, the grapes of this vine can be kept fully 3 months. If required for keeping, the grapes should be gathered before they are quite ripe.

Seibel No. 5409, on the other hand is one of the cases of true hybrids needing no treatment in normal years. It has already proved its worth though not very extensively, as a producer of excellent table grapes. The bunches are of average size and round, with spherical crisp, very sweet grapes, above the average size ; their flavour is excellent. These grapes bear transport well. They ripen late in the first period.

Seibel No. 5901 resembles the former in its characters, and the quality of its grapes, which are above the average size, round and crisp, i. e., firm., and carry well. They ripen at the same time as those of *S.* 5409. Its foliage seems very resistant to mildew ; it also withstood oidium well in 1920.

Two other later white hybrids can also be recommended for supplying the table : *Seibel* Nos. 4762 and 867. They are very resistant, needing no treatment and they also have the advantage of producing grapes that ripen late in the 2nd period and can hang a long time on the vine without rotting. Hence, when the early varieties are over, these grapes provide fresh fruit without it being necessary to touch the reserve store. They also keep very well. The bunches are composed of average size berries which are very sweet and delicate.

Persons liking grapes with a musk flavour can gratify their taste by growing a recent *Seibel* No. 6102, without having recourse to the numerous

treatments required by the Muscatels of Hamburg, Alexandria, Frontignan, etc. This vine is very resistant and productive.

The author does not advise the cultivation of the following hybrids, unless they are to be looked after like Vineferas: Malègue 51-20, which has grapes of a true muscatel flavour, and No. 1897-12 of the same hybrid. The latter is a little less susceptible to disease than the former, but nevertheless needs a good deal of treatment.

The author is also very reserved on the subject of the Couderc hybrid surnamed *Muscat du moulin*; he never found it in good condition, although it had been treated several times.

As excellent and very decorative table grapes, two *rose-coloured Seibel* hybrids should be mentioned: —

(1) No. 5670, of the 1st period, with average bunches composed of firm, crisp, very sweet grapes with a delicate flavour. The bunches can hang on the vine without injury. The foliage is very resistant.

(2) No. 6090 ripening at the 2nd period; it bears splendid grapes that keep for a long time. The foliage resistance is good.

The author concludes his description by mentioning 2 black hybrids producing grapes that would grace any table. One, *Seibel* No. 4643, whose fruit ripens at the beginning of the 1st period, has average sized bunches, with medium, round, fairly firm, very sweet, high-flavoured grapes with a delicate taste.

The other *Seibel* No. 5813, is of more recent cultivation, and may be used as a substitute for Morterille, or Cinsault from South-West France, The bunches are only of medium size, but the berries are large, ovoid, and crisp, ripening during the 2nd period. They stand travelling well, and will be as useful as the grapes of Morterille for sending to countries where black table grapes are in demand. The foliage will probably require treatment with sulphate in seasons when disease is rife, but this hybrid is at all events immune to oidium, which renders it clearly superior to Morterille.

As we have just seen, Franco-American hybrids are in no wise inferior to French vines as regards the character and variety of their fruit. After those furnishing colouring grapes for blending, and the grapes used in making the ordinary red and white wines, the magnificent golden and succulent dessert grapes should be mentioned. It may also be added that grapes with a muscatel flavour suitable for making liqueurs are also to be found among the products of these crosses.

The chief reason for ranking them above the *Viniferas* is that they can easily be cultivated without many applications of Bordeaux and other mixtures, and of copper and sulphur powders, which give a bad appearance to the grapes and greatly increase the cost of production.

879 – **Vines Affected by the Frosts of April 6 and 7, 1920** (1). — Biron, M. in *Le Progrès agricole et viticole*, Year 37, No. 21 pp. 495-496. Montpellier, May 23, 1920.

The author studied the effect of the white frost of April 6-7, 1920, upon the vineyards which had suffered most. These were situated on rich

(1) For the behaviour of frost-bitten vines in North Italy see *R.*, June, 1920, No. 664. (*Ed*).

soil (ancient alluvium) on the banks of the Hérault. He summarises his observations under the following headings:

(1) *Influence of the configuration of the ground.* — The vines growing on the sloping ground bordering the river (at the height of about 1 metre above it), had not suffered at all, in most instances.

(2) *Effect of ploughing.* — The author first investigated the *gobelets bas* or vase-shaped vines, this type of pruning being the commonest in the district.

Vineyard ploughed the day before the frost.	Great damage
Surface of soil turned over	
Many clods and weeds dug in	
Vineyard ploughed (weeds high)	Great damage, but less than in previous case
Vineyard ploughed without ridges (without weeds) . .	some damage.

Vases of new shape (very short branches on high stem).

Stock uncovered	No injury observed (except on a few very low vines)
Vines earthed up 1 ridge	More or less injured, but not seriously
» » 2 ridges	
» » » completely	
» » » with grass	
» » » without grass	

(3) *Influence of the Vine.* — The observations refer to vines situated under the same conditions.

Bourrets	No injury
Clairettes	No injury
Carignans	No serious injury
Aramons	Serious injury
Alicantes	Serious injury
Jacquez	Buds totally destroyed

(4) *Effect of method of pruning.* — Vase-pruning: The young low vines suffered more than the others.

Vase-pruning (very short branches on tall stem): — (*a*) little injury in the case of uncovered vines; (*b*) some injury to earthed up, or grassed up vines; (*c*) vines grown on wires hd not been touched by the frost.

(5) *Effect of date of pruning* — Vines that had undergone "espoudrassage" (1) and then repruned a fortnight before the frost, were found to have suffered least.

Conclusions. — From the preceding observations, the author was able to draw the following conclusions: —

A vine suffers less from the effects of frost in proportion to its height above the ground, and to the compactness of the soil.

(1) « Espoudassage » is the system of autumn pruning, which consists in cutting out the surplus shoots and those which will be repruned in spring to a height of 50—40 cm. (See *Dictionnaire d'Agriculture et de Viticulture.* Seltensperger (*Ed*).

Other factors of equal importance are the frost resistance of the vine and its power of breaking from a second eye found at the base of the young shoot in certain varieties (Aramons).

880 – **The Figs of Smyrna.** — *The Cyprus Agricultural Journal*, Vol. XV, Pt. 2, pp. 189-190. Nicosia, April, 1920. FRUIT GROWING

Some thirty years ago only about 10 000 acres of land in the Vilayet of Aidin were planted with fig trees which gave an average crop of about 9000 tons ; to-day the orchards cover some 25 000 acres, and 23.000 tons is the medium yield. However, the cost continues to advance, but, notwithstanding this fact, the demand keeps steadily ahead of the supply. The majority of fig plantations are owned by Turkish peasants, being mostly found in the Meander Valley. The districts where the best figs are produced are Inovassi and Ortaxe. The transport is dependant enterely on the single railway line belonging to the Ottoman (Aidin) Railway Company. The quality of the Smyrna fig is superior to all other. The fruits are dried by the peasants and transported to the markets in Smyrna where they are sold to the highest bidders. Packing methods are then adopted to suit the requirements of the different countries to which they will be exported.

LIVESTOCK AND BREEDING

881 – ***Syngamus laryngeus* Parasite in Cattle and Buffaloes in India.** — SHEATHER, A.I., and SHILSTON, A. W. in *Agricultural Research Institute Pusa, Bulletin* No. 92, figs, 28. Calcutta, 1920. HYGIENE

Nearly 200 buffaloes, 100 plains cattle and 500 hill bulls have been examined by the authors. Worms (*Syngamus laryngeus*) were found in about 13 % of the buffaloes and hill bulls and about 15 % of the plains cattle, and were as a rule attached to the larynx. The maximum number of worms found on any one animal was 17 in the case of hill bulls, 24 in the case of buffaloes, and 16 in the case of plains cattle. Generally, however, only. one or two were found.

The only published account of a *Syngamus* parasite occurring in cattle appears to be that by M. RAILLIET in the *Comptes Rendus de la Société de Biologie* for 1899, p. 174.

The parasite, the morphology of which is described in detail by the authors, does not cause material damage to the animal which serves as host, as a general rule. Occasionally, however, the pharynx becomes affected, followed by congestion.

882 – **New Methods of Treating Epizootic Aphthic Fever** (1). — DE BENEDICTIS, A., in *La Propaganda agricola*, Second Series, Year XII, No. 7, pp. 95-99. Bari, April 15, 1920.

During the outbreak of epizootic aphthic fever in Italy in 1919, several methods of treating it were suggested : those proposed by Prof. TERNI and Prof. MORI (2), respectively, gave satisfactory practical results.

(1) See *R.*, March, 1920, No. 335.
(2) Abstract in *R.*, July-Sept., 1919 No. 923. (*Ed*).

Prof. TERNI advises the use of the following remedes : 100 gm. ether + 100 gm. 95° alcohol + 100 gm. physiological salt solution (0.8 gm. of sodium chloride in 100 gm. distilled water) + 15 gm. crystallised carbolic acid. This mixture is injected subcutaneously daily during the acute stage of the disease (4-5 days), and then every 2 days for 5-6 days ; from 20-30 cc. being used for large animals, half the amount for those of average size, and a quarter for small ones.

Simple sub-cutaneous injections of carbolic solutions have also given good results : 5 gm. crystallised carbolic acid + 100 gm. of physiological salt solution ; the doses being 20 cc. for large animals, 10 to 5 cc. for average sized and from 5 to 10 cc. for small ones.

The best place for the inoculations to be made is in the region behind the shoulder and in front of the stifle, and the hair should be shaved off an area 30 cm. square in order to be able to disinfect the skin with alcohol.

In very serious cases, in addition to giving these injections it is necessary to give cardiac stimulants. Prof. TERNI advises the injection of 25 cm. caffein + 34 gm. sodium benzoate + 100 gm. of distilled water, the amount used being 10 to 20 cc. for large and average-sized animals, and from 5 to 10 cc. for small ones.

The infected animal should be kept on reduced fare during the fever period, and should gradually return to its normal rations. The intestine should be kept quite free, in order to prevent the development of gaseous fermentation in the rumen and intestine due to the presence of excreta, which hinders the circulation of the blood, and fatigues the heart. In order to prevent such fermentation, especially in the rumen, it is well to give every second day a dose of sodium hyposulpite dissolved in tepid water (150 to 200 gm. for large animals, 100 gm. for average-sized and small ones).

883 – **Stomach Worms in Sheep. Prevention and Control.** — *United States Department of Agriculture, Department Circular* No. 47, pp. 1-10. Washington, D. C., Aug. 1919.

Amongst the stomach worms in sheep which give rise to serious difficulties owing to economic losses thereby entailed, must be included *Haemonchus contortus* which is common on farms in North America, particularly during wet summers. This parasite has been studied in detail by the Zoological Division of the Department of Agriculture, and although still under investigation, sufficient information has been gathered to show how affected sheep can be successfully treated, and also how to combat the parasite by means of adequate prophylactic measures.

MEANS OF RECOGNISING SHEEP AFFECTED BY " HAEMONCHUS CONTORTUS " IN THE STOMACH. — In most cases, the disease is only discovered by the death of one or more lambs, followed by a post-mortem examination. If however, the flock is under careful observation, signs of disease will be noticed on the living animals. Towards the middle of summer, or even before, dullness and general indisposition are among the first indications, accompanied with a bloodless appearance of the skin, and of the mucous membanes. The whiteness of the skin has caused the trou-

ble to be termed in some sections " paper skin ". In many cases there is a watery swelling under the jaws.

Doubt as to the cause of the trouble can be removed by an examination of the 4th stomach as anyone unfamiliar with the ailment can well afford to kill the animal in question. If the *Haemonchus contortus* is present, they can be seen, often in large numbers, wriggling around in the stomach fluids. The worm measures from ½ to 1 ¼ in. in length ; it is as thick as an ordinary pin, and spirally striped with red and white. When the stomach is empty, some of the worms can often be seen adhering to the mucous lining of the stomach.

How can the Worms injure the Sheep ? — The injurious action of these stomach worms may be attributed to two causes:— first, the loss of blood abstracted by the parasites, and second, the destruction of red corpuscles by a poisonous substance which is secreted by the parasites, and which passes into the blood circulation. Evidently the older sheep are more resistant to attack than the lambs. Furthermore, in the blood of adult sheep, there appear to be substances tending to neutralise the poisonous matter secreted in the parasites that are absent from the blood of lambs, or that, if present, occur in smaller quantities. Besides the direct injury caused by stomach worms, it should not be forgotten that damage may also be done by bacterial infection through the wounds made by the worms in the mucous lining of the stomach.

Treatment of Infested Sheep. — (a) *Medicinal.* Dissolve ¼ lb. of powdered copper sulphate in ¼ pint of boiling water. Add sufficient cold water to make the solution up to 3 gallons. This will make approximately 1 % solution and enough to dose 100 adult sheep In the preparation thereof, only clear blue crystals of copper sulphate should be used, and these crushed into powder each time. The following doses to be administered per head are here quoted. namely: — lambs under 1 year 1 ¾ oz., sheep over 1 year old 3 ½ oz.

For purposes of administration, is employed: (1) a strong rubber tube measuring about 3 ft. long and ⅜ in., in diameter ; (2) a hard rubber, porcelain or enamel funnel at one end of the tube ; (3) a brass mouth piece 1 in., long and ⅜ in., diameter, fastened to the other end. It is preferable that the end of this tube should be closed at its lower end, and holes made in the sides about the last two inches of its length.

It is wiser to apply this treatment when the animals are fasting. For the best results, sheep should not be watered for 2 hours afterwards.

While being treated, care should be taken that the liquid is kept free from the windpipe and consequently from the lungs. The animal must therefore be held horizontally and the brass mouthpiece placed in the mouth not to reach farther than the base of the tongue. The liquid should not be administered rapidly, but sufficient time allowed for the sheep to swallow comfortably.

(b) *Change of Pasture.* — Although losses from stomach worms, may in many cases be minimised by the above mentioned treatment,

it is always advisable to change the pasture and place the flock on ground free from infection.

It is wise to institute preventive measures before the infection becomes evident, in order to forestall economic loss. It is important therefore that the shepherd should know how and when infection occurs

Method by which Sheep become infested by *Haemonchus contortus* :—

a) *Infested pastures.* — Stomach worms are able to live and carry out their reproductive function only in the alimentary canal of sheep and other ruminants, and usually only in the 4th stomach.

Each female produces thousands of eggs, which pass out of the intestine in the feces and which in a few hours, days or weeks, according to the temperature, if they are not killed by drought or frost, start to hatch. The larvae are able to withstand inclemency of weather and periods of drought better than the eggs. During the larval stage, the stomach worm is active in the presence of moisture. A decrease in relative humidity causes momentary suspension in activity. In the stomach of the sheep in the course of 2 or 3 weeks the worm reaches maturity.

The length of life of a worm in the stomach has not yet been determined. Experiments have nevertheless demonstrated that 19 months after the first sign of infection, stomach worms were still found, although in limited numbers. These experiments do not prove anything definite, as there is always a possibility of reinfection developing through the feces of the sheep in question. If these experiments prove nothing as to the length of life of the adult worm, they demonstrate however the futility of attempting to rid sheep entirely of stomach worms by simply keeping them away from infested pasture.

b) *Length of time pasture may be infested.* — The maximum period during which the larval stomach worms are able to survive on pastures, or pastures on which infested sheep are grazed is not yet definitely known. It has however been found that larvae were still apparently active after nearly 8 months (October 25 till June 16). Laboratory tests have proved that larvae are still alive after 9 months (September 14 to June 5). Cultures in which the larvae were allowed to develop still showed signs of vitality after 2 or 3 months, although submitted to a temperature of 0° and even lower, while in other cultures, eggs and newly hatched worms were killed within a few hours when exposed to a similar temperature.

These observations show that the pastures may remain infected by larvae several months after sheep have been removed. They show in every case that cold hinders a spread of infection on pastures occupied by infested sheep.

There are two ways by which a pasture may be freed of infection :— 1) by excluding sheep and other ruminants for at least 1 year from previously infected fields ; 2) by turning the pasture into a cultivated field.

Methods to be employed to Prevent Loss from Stomach worms. — In seeking to find a method which will eliminate the evil effects of

stomach worms, it is necessary at present to be content with reducing the amount of infection to a minimum, and maintaining this standard.

a) *Early development of lambs.* — It has been proved that if the lambs are born early in the year and fed as much as possible before they are sent to pasture, the danger of infection will be practically negligible, as the lambs will develop into a marketable weight before the summer.

If, however, lambs must remain for several months on pasture, frequent changing of pasture will be necessary.

b) *A practicable method of pasture rotation.* — It has already been stated that a pasture occupied by infested sheep ought to be kept from use for a year at least in order to become freed from stomach worm larvae.

From 10 to 20 days, according to temperature and moisture, must intervene between the feces containing eggs, and the development of the larvae. If the sheep are moved into pasture before the eggs develop into larvae, there is no danger of infection. The practical difficulty lies in always having fresh pasture available. If the same pasture is always used it would be necessary to separate into lots, allowing the flock to be moved at least every 2 weeks, and without occupying the same ground twice within 12 months.

Ploughing the land infested, following by sowing forage crops, greatly reduces the danger of infection. This fact allows the same land to be use 2 or 3 times each year for sheep grazing. Even the lambs can stay there, and this is a distinct advantage as they may safely remain there from weaning time until the winter.

If this pasture rotation system is employed in conjunction with the treatment described, excellent results will be obtained.

884 – **Rabbit Coccidiosis.** — Vilcoq (Director of the School of Agriculture at Chesnoy, Loiret, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 24 pp. 609-613. Paris, June 23 and 30, 1920.

In many country places, rabbit rearing is attended with serious difficulties on account of the diseases with which the rabbit-breeder is obliged to contend. One of the commonest of these maladies is hepatic coccidiosis, popularly known as « maladie du gros vente » (swollen belly).

The infected animals gradually lose their appetite, grow thin and weak, becoming anaemic and having all the symptoms of cachexia. The abdomen swells, diarrhoea sets in, and death supervenes in from 2 to 3 months. The liver is hypertrophied, and covered with whitish or yellowish-white patches, usually of the size of a millet-seed, which occur isolated or in streaks, and contain a sort of cream-like mixture.

The disease is due to *Coccidium oviforme*. The author gives its symptoms, and speaks of the wide-spread nature of the malady and the measures adopted for its prevention. He describes the curative treatment he employed and states that the ether extract of the roots of the male-fern containing 24 to 25 % of the active principle, filicine, has undoubtedly a therapeutic effect upon hepatic coccidiosis. Although the experiments

made were not sufficient to allow of being able to give an exact prescription, the author thinks that 0.75 gm. of extract mixed with 4 gm. of sweet oil would be sufficient, in the majority of cases, to effect a cure. In his experiments, the infected rabbits were at once isolated and some oats were added to their food to make it more nourishing. After a short time, they regained strength and were on the road to recovery. The cure was complete, and the rabbits, on being killed for the table some time later, were found to be suffering from but slight hepatic troubles.

FEEDS AND FEEDING

885 – **Nitrogen Metabolism of Two Year Old Steers.** — Bull S., Grindley, H. S., in *Journal of Agricultural Research*, Vol. XVIII, No. 5, pp. 241-254. Washington D. C. Dec. 1 1919.

The authors conducted an experiment on metabolism at the Illinois, Agricultural Experiment Station, upon eight 2 year old steers, covering a period of 37 weeks. Determinations were made of the quantities of nitrogen ingested and excreted and the results are expressed in the appended Tables, and in the discussion.

The steers maintained a positive nitrogen metabolism for long periods, when receiving considerably smaller amounts of digestible protein than are usually considered necessary for maintenance.

Curves showing the nitrogen consumption, the total nitrogen excretion, the urinary nitrogen, and the nitrogen balance are more or less parallel.

Steers which received larger amounts of nitrogen stored larger amounts.

The authors state that 14.7 % of the total increase in live weight was protein. Each steer stores from 18.9 to 25.1 % or an average of 22.37 % of the protein digested. Although the various lots (2 animals per lot) were given different feeds, varying from the ordinary maintenance ration to the maximum amount readily eaten by steers and although the proportion of maize in the ration had been increased as the experiment proceeded, and that towards the end of the latter, linseed oil meal had been introduced (during the preceding part of the experiment the chief feed was clover hay) ; the differences in treatment had no effect upon the percentage of protein in the increase of live weight, nor on the percentage of nitrogen absorbed and retained. As a general rule in every case, there was a decrease in the percentages of protein stored, towards the end of the experiment, but this fact may be attributed to the advancing age of the animals.

Out of 284 nitrogen metabolism records, 5 only gave negative results, two concerning maintenance fed steers and 2 on full feed.

886 – **The Use of Weeds as Forage.** — Pouget I., in *Revue agricole de l'Afrique du Nord* Year 18, No. 51, pp. 61-63. Algiers, July 23, 1920.

Many wild plants are refused by animals when they are offered to them dry, though they are readily eaten in the form of silage. This is the case with the weeds that grow very rapidly in spring time on waste ground or on the roadsides ; they could often be used for feeding stock but at present are only rarely turned to account.

In Tunisia, Col. REBILLET has obtained excellent results with a mixture containing nettles, wallflower, sow-thistle, euphorbia, mallow, fumitory, thistles, arums, and the leaves of asphodel, fennel, etc.

In Algeria, M. BARROT, of Philippeville, collected all the wild plants which grow more or less everywhere and ensilaged them.

M. LÉVY, of Sétif, did the same, and thus obtained a large amount of additional food for his large dairy farm. The plants chiefly found in his silage are rat barley, a wild lucerne, some kinds of ray-grass, mustard, brome-grass, and species of *Leucanthema*.

When ensilaged, the food value of these plants compared well with that of ordinary forage, crops as is shown by the following analysis :—

	Unsilaged green forage	Silaged forage
	Per cent.	Per cent.
Water	75.0	76.0
Ash	2.0	3.3
Total nitrogenous matter	3.1	2.1
Fats	0.6	0.6
Cellulose	6.1	6.1
Sugars	1.0	—
Extracts (not sugars)	4.6	1.8
Starch	7.6	6.1
Butyric acid	—	4.0
	100.0 %	100.0 %

It is well known that forage always loses weight by being silaged, and this loss may here be estimated, from the increases and the ash content, at about 30 %. This loss of weight is chiefly due to the disappearance of the sugars, and the decrease in the extracted matter, nitrogenous substances, and especially the digestible nitrogenous substances (the latter

Character of forage ensilaged	100 parts of the forage contain:—								
	Crude principles					Digestible principles			
	Dry matter	Protein (total nitrogenous matter)	Fats	Nitrogen-free extract	Cellulose	Protein	Fats	Nitrogen-free extract	Cellulose
Lucerne	16.9	3.7	1.4	4.8	5.0	2.5	0.7	3.3	2.1
Red Clover (*Trifolium pratense*)	21.7	4.4	1.2	6.9	6.5	2.9	0.6	5.1	3.5
Forage of Gramineae and Leguminosae	20.0	3.4	1.0	7.2	6.0	2.2	0.5	5.1	3.3
Maize	18.5	1.6	0.8	9.0	5.7	0.8	0.4	6.2	3.2
Forage consisting of weeds	20.0	3.3	0.6	7.9	6.1	1.6	0.3	4.9	3.0

formed 2.6 % of the green forage, and only 1.6 % of the silaged forage).

In the present case, these losses are only of secondary importance, for the process transformed worthless raw material into a valuable food. Further, it is possible to reduce these losses to a minimum.

In the present case, acid silage was made, as is shown by the large proportion of butyric acid present. In making sweet silage the losses are much less. It would be of advantage, therefore, to obtain sweet silage, which can be done with certainty by adding to the mass, at the moment of ensilage, lactic ferments (such as the lacto-pulps of MM. BOUILLANT and CROLBOIS (1).

The above table giving, on the one hand, the average composition (according to KELLENER) of some silage forages and, on the other, the composition of the silaged weeds, shows that the latter is of quite the same value as the former, which consisted of cultivated plants.

887 – **The Use of Poppy Seed Cake as a Cattle Food and Its Effect on Yield of Milk and Composition of Butter.** — ANNET H. E., and SEN J. N. in *The Journal of Agricultural Science*, Vol. IX. Pt. 4, pp. 316-429, charts 7. Cambridge, Oct., 1919.

India produces a considerable quantity of poppy seeds, the greater part of which is exported, especially to France. This seeds is used chiefly for oil extraction, and the residue forms the so-called poppy oilcake. SMETHAM gives the following analyses of this oilcake :—

Water	10.15 %
Albuminoids	35.38
Oil	11.43
Carbohydrates	20.04
Woody fibre	7.90
Ash	15.10

It is generally believed that this oilcake encourages the animals to become sleepy. KELLNER considers that poppy oilcake is injurious to milk or young cattle or pregnant animals, but is suitable for fattening stock

The experiments undertaken by the authors were designed essentially to detect any noxious properties in poppy oilcake and to determine its nutritive value ; but there were not sufficient animals for this latter purpose. One cow (Phulia) and two buffaloes (Rukminia and Lachminia) were the only available animals for the experiment.

The buffaloes received a daily ration of 20 lb. straw, 6 lb., bran, 3 lb., of pulse husks, and 3 lb., mustard cake. The cow's feed consisted of 13 lb., straw, 6 lb., bran, 2 lb. husks, and 2 lb. mustard cake. At a certain date the mustard cake was substituted by an equal amount of poppy cake and this was continued for 6 weeks.

The weight of the animals from beginning to end of the experiment did not signify any marked change : the cow showed a diminution of 28 lb., one buffalo 14 lb. and the other conserved its initial weight. The

(1) See *R.*, January, 1916, No. 109; *R.* Feb., 1916, No. 232; *R.* Feb., 1918, No. 221; *R.*, Feb. 1919, No. 257 ; *R.*, July-Sept., 1919, No. 1010; *R.*, July-Aug.. 1920, No. 802. (*Ed.*)

condition of animals was not found to be affected by the action of poppy cake ; there was no indication of the reputed action of the same in bringing about drowsiness.

The quality of the milk and butter remained the same during the whole course of the experiment. With regard to the milk yield, the cow Phulia yielded on an average 10.2 lb. milk per day during the first period (fed on mustard cake), 9.6 lb. during the second period (poppy cake) and 10.2 lb. in the third period (mustard cake). The buffalo Rukminia yielded 10.5 lb. milk per day during the first period and 7.5 lb. during the second, during the course of which she dried off. The yields of milk by the buffalo Lachminia were 13.5, 15.3 and 14.9 lb. respectively during the 3 periods of experiment. Judging these data as a whole, the feeding of poppy cake in place of mustard cake does not seem to injuriously affect the milk yield.

The average fat contents in the milk were :— 3.6,04.3,05.3 % for the cow ; 5.5 %, 6.1 % and 6.4 % for the buffalo Lachminia during the 3 periods respectively. The buffalo Rukminia's milk contained 6.8 % during Period I, and 7.5 % in Period II. Poppy cake did not appear to have any deleterious effect on the fat content of milk.

The authors also conducted investigations as to the composition of butter fat and made determinations of refractometer values, the Reichert-Meissl number, the Polenske number and the saponification value.

The average refractometer figures at 40° C for butter fat from cow's milk was 42.3 during Period I (mustard cake ration) 40.7, during Period II (poppy cake ration), and 40.2 during Period III (mustard cake ration) The average figures for the buffalo Rukminia were the same for the Periods I and II and the variation was 0 to 0.7. The refractive index for Lachiminia for the 3 periods was 41.4, 40.4 and 40.8 respectively.

Reichert-Meissl numbers. — Butter fro mmilk yielded by the cow gave an average of 27.4, 28.7, and 30.6 at the 3 periods respectively ; 26.6 and 25.7 for the buffalo Rukminia, in Periods I and II ; 36.1, 37.4 and 36.1 for the buffalo Lachminia at the 3 periods respectively.

It may be concluded as a result of the comparison of the refractometer values and of the Reichert-Meissl numbers that, generally speaking, a fall in the refraction value is accompanied by a rise in the Reichert-Meissl number.

Polenske numbers :— Butter fat of milk from the cow had the average values of 1.8, 2.0, and 2.4 for the 3 periods ; the corresponding figures for Lachminia being 2.0, 1.1 and 1.7 respectively, and for Rukminia, 1.3 and 1.4 for Periods I and II.

Saponification values : — Butter fat of milk from the cow for the periods were respectively : 219.3, 228.3, and 228.6 ; for Lachminia, 223.6, 233.6 and 230.0, and for Rukminia, 214.6 and 222.2 during Periods I and II respectively.

The author has drawn the following conclusion : the substitution of poppy seed cake for mustard cake does not produce any ill effects. The animals readily ate the first mentioned cakes ; but the amount fed, however, was not great.

BEEDING

888 – **Reorganisation of the Normandy Herdbook.** — BERGE, R., in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 18, pp. 479-484. Paris, May 19th 1920

The author laid before the Academy the new regulations, as well as the new score to be adopted in the Herdbook of Normandy Cattle which has just been entirely changed.

Since the end of 1919, the Regional Agricultural Office of the North has been engaged in re-casting this Herdbook, having been encouraged to undertake this task by the progress already made in other countries, particularly Holland, and the special conditions of breeding and using Normandy cattle.

A Commission held several meetings for the purpose of drawing up the new regulations which were finally adopted on May 8, at Caen, first at a full meeting of the Herdbook Commission, and afterwards, at an important meeting, to which had been invited a large number of the breeders from the 5 departments of Normandy.

The former Herdbook Commission had been composed of 15 members, 3 being appointed for each department by the Prefects of la Manche, Orne, Calvados, Eure, and Lower Seine. It was presided over by the Prefect of Calvados.

It was constituted a legally-recognised Association, capable of including all persons or associations interested in breeding the Normandy breed of cattle, and willing to conform to its statutes and regulations. The Association is of unlimited duration.

Its principal work is to keep a Herdbook, in which it has been decided to enter, in the case of each animal, its purity of breed, points, performance, and a well-authenticated pedigree (Art. 4 of regulations).

Article 5 states that the special objects of the Association are :— to preserve, by means of selection, the purity of the Normandy breed of cattle ; to contribute to improving their performance as beef and dairy animals ; to encourage the rearing of stud cattle for breeding purposes, first in Normandy, then in other suitable parts of France, and finally abroad. Severe penalties are to be imposed upon any member, who by wrongful action, shall do anything to hinder the progress of the work of the Herdbook Association.

The Association is administered by a Council consisting of :—

1) Fifteen members (3 for each of the Departments of Normandy) elected for 3 years by the General Meeting ; one additional member shall also be nominated annually for each of these Departments by the General Meeting.

2) The President of the Regional Agricultural Office of the North, or his deputy.

3) The President of the Regional Chamber of Agriculture of the Departments of Normandy, when appointed, or his deputy ;

4) The 5 Directors of the Agricultural services of the Departments of Normandy, or their deputies, Professors of Agriculture.

One third of the 15 members nominated are eligible for re-election every year. The subsequent article of the regulations fix the composition of the Committee, which is nominated by the Council, and define the powers of its members, the nature of the resources of the Association, and provide that if it should be dissolved, its funds shall be devoted to the improvement of the Normandy Breed of Cattle.

The Score gives the scale of marks awarded for purity of breed, points, performance, and pedigree.

It fixes the standard of the breed.

Two classes of animals are at present registered :— (1) Those admitted on their own merits (breed characters and points) ; (2) the offspring of parents already entered in the Herdbook.

From a date to be fixed by the Council of Administration, only the progeny of cattle already registered will be entered.

The chief innovation that has been introduced into the Normandy Herd-Book is an Advanced Register (*Livre d'Élite*), in which may be entered by order of the committee: —

(1) Bulls and cows having at least 2 generations of ancestors registered in the Herdbook, and which themselves have all the pure-bred characters, and have been prize-winners at general shows or special shows for Normandy cattle.

(2) Breeding animals which are considered by the Registration Committees as of exceptional merit, especially pure-bred cows, with very good points, having produced (according to the figures of the Syndicates of Milk Control, achnowledged by the Committee) larger amounts of milk and butter than those fixed annually by the Council.

Great care is taken in the registration of the offspring. Each owner of a registered bull is given a book of forms with counterfoils, in which to enter the services of the animal.

When a registered cow is served by a registered bull, the owner of the former sends, within 6 months of the date of the last service, a certificate of the service made out on one of the forms of the book.

During the week following the birth of the calf, the owner, on his own responsibility, sends to the Herdbook Committee the birth-certificate of the animal, together with a fairly detailed description, mentioning especially the markings and patches of colour on its face and cheeks.

As soon as this certificate reaches the Herdbook Committee, the latter appoints an Inspector to investigate the correctness of the information furnished.

These Inspectors are chosen preferably from the Inspectors of the Dairy Syndicates, the Members of the Breed Syndicates Committee, of Mutual Cattle Insurance Societies, or of other Associations. They can also receive a salary which is fixed by the Council. In addition, the Council has also the power of assigning the work to one or more Inspectors appointed by the Herdbook Association.

Animals thus recognised are entered on the merits of their lineage.

In the case of each registered animal, there is provided a separate

numbered sheet stamped by the Herdbook Committee, on which the owner writes the pedigree of the animal, notes regarding its points, prizes obtained at Shows, and in the case of cows, the results of the tests of its milk and other dairy produce, and the destination to which they are sent.

Then come some regulations of a general character, of which the following are worthy of mention :—

Markings. — The animals shall be marked in a certain special manner by tatooing in the inside of the left ear.

The breeder is required to send a photograph to be put in the Advanced Register.

Certificates. — Registration certificates for animals to be exported shall be granted under the auspices and control of the Ministry of Agriculture, and of the National Society for the Encouragement of Agriculture. A clear distinction shall be drawn between Herdbook certificates, and Advanced Register certificates.

Publications. — The Council shall publish a periodical Bulletin, as well as notices and monographs respecting the best animals, and the best herds of the Normandy breed. The former Herdbook Committee has bequeathed all its property to the Association which has superseded it, and which will enter on its registers all the animals already entered on the Normandy Herdbook.

889 – **Herdbooks.** — Dechambre, P., in *Comptes Rendus de l'Academie d'Agriculture de France*, Vol. LI, No. 20, pp. 498-505. Paris, May 26, 1920.

A report made in the name of the Section of Animal Husbandry (*Section d'Économie des Animaux*) upon a paper by M. De Lapparent entitled "*Les livres généalogiques*". The Association supports M. De Lapparents' suggestion, and recognises that for the progress of stock-breeding, it is not only of advantage to have Herdbooks for all kinds of animals, but that it is necessary to institute them in France with as little delay as possible.

Breeding must be intensified, in order to make good the deficit due to the loss and slaughter of stock, but attention should also be paid to increasing the individual yield, in order that greater productivity may be obtained with fewer animals. In fact, the increase in individual yield is perhaps a more important and efficacious factor than the actual multiplication of the number of head.

This leads to an expression of opinion regarding the general organisation of stock-breeding methods in France.

The creation of a strong organisation to supervise and direct stock-raising in France is the only means of thoroughly and systematically improving it. The Section is of opinion that a Stock-breeding Department (*Direction d'Élevage*), or if preferred, a Department of Animal Industries, should be established at the Ministry of Agriculture, having under its jurisdiction all matters relating to foreign trade in domestic animals, their breeding, exploitation, feeding, improvement, and hygiene. Further, that this Department should work on the lines adopted by the

Bureaux of Animal Husbandry in the United States, and that it should be called upon to give a strong impetus to all branches of stock-raising.

While awaiting the creation of this organization, and in order to prepare the way, it would be well to appoint a Chief Stock-breeding Council (*conseil supérieur de l'Élevage*) to study all questions, which like that of the institution of Herdbooks, are certain to have a decisive influence on the raising and yield of the various races of animals.

The Section of Animal Husbandry (*Section d'Économie des Animaux*) thus proposes that the Academy shall adopt the following resolutions :—

(1) That herdbooks shall be instituted and extended as rapidly as possible.

(2) That the period during which so-called original entries are permitted shall be brief, that is to say, 5 years.

(3) That these herdbooks shall only be used for well-defined breeds and those of real economic importance.

(4) That the statutes shall provide for the severe control of the births and the careful marking of the animals.

(5) That the juries of the itinerant shows, who are already qualified for judging bulls, shall always conclude several members of the Herdbook Committee that are especially entrusted with the task of pronouncing upon the admissibility of the animals shown. No animal may be entered on the herdbook that has not the minimum marks required by the said Committee.

(6) That, to insure the systematic improvement of the stock, stock-breeding must be thoroughly organised in France by means of the creation of a Bureau of Animal Husbandry.

M. R. BERGE states that all the opinions expressed by the Section of Animal Husbandry and formulated in M. DECHAMBRE'S report, are already realised in the new Statutes and Regulations of the Committee of the Normandy Herdbook (1).

890 – **Native Horses and Cattle in China.** — LEVINE, C. O. (Canton Christian College), in *The Journal of Heredity*, Vol. XI, No. 4, pp. 147-155, figs. 4, bibliogr. of 13 works, Washington, D. C., April, 1920.

HORSES. — Horses, donkeys and mules have been little used in China, except in the northern and western provinces, where they are used almost exclusively as pack animals and for riding.

The southwest and western border of China and Tibet is the native home of the Chinese pony, which is known under the name of Tibetan or Chinese pony.

Up to the present time no horses have been raised in Kwangtung. Horses have been imported chiefly from Yunnan. The Tibetan pony is excellent for this region where it thrives well in this climate ; its somewhat small size (it usually weighs about 500 lb.) is well suited to the narrow roads and the steep gradient bridges. It appears to keep quite free

(1) See No. 888. of this *Review* (*Ed.*)

from diseases and unsound constitution; the better horses are intelligent and easily trained, provided they have not been improperly handled. They have colours common among other horses: black, white, sorrel, bay, tacheté, grey, white, iron grey, with bay predominating.

The Mongolian horse is quite common in the north of China. It is considerably larger than the Tibetan pony, weighing about 700 to 800 lb., or more. It is supposed to be the ancestor of most of the modern breeds of horses. It is raised in Mongolia in a semi-wild manner. It is strong and swift, fairly free from diseases, but does not succeed well in Southern China. It is the horse used in the annual races of Shanghai and Hongkong; in Canton there are only about 50 as compared with about 250 Tibetan ponies.

In Canton the demand for horses is rapidly increasing. The usual concentrated feed for horses consists of maize, cooked rice (this is used also for other classes of livestock), wheat bran and roughage such as green grass and straw, which are usually cut up before feeding.

CATTLE. — Shantung, Chihli and Honan provinces in the north, and Szechwan, Yunnan and Kwangsi in the southwest, produce cattle in the largest numbers. Estimates would place the number of native cattle at 50 million at least, and the average value of these at $30.00 (Mex.) a head. The export of cattle from China is small, but is ever increasing; from 1915 to 1919, exportation has increased from 1000 to 100 000 cattle per year.

Shantung is one of the biggest cattle producing provinces in China.

Generally speaking, the Shantung cattle are large in build. The ox usually weighs from 600 to 1000 *catties* (1 catty = 1.33 lb.), and has well developed loins and limbs which lends the form an almost rectangular shape. According to a native, a German missionary imported cows of a foreign breed with which he undertook the improvement of cattle in this locality; this was the origin of the present day cattle. The fact which demonstrates that the Shantung cattle are an improved type is the comparatively thin hide, and what is more, the tendency to early growth and fattening. A large number of cattle now in Shantung were introduced from Honan. Although they are called Shantung cattle, there is no doubt that they originated in Central China; they have gradually migrated eastward from Honan, Shonsi, Shansi, and Kansu, which are situated in the centre of continental China. The Yellow River which passes through these territories, makes the vicinity of its watercourse unfit for cultivation owing to the tremendous overflow of the river which takes place annually; the district forms as a result, one vast pasture land of thick weeds, and the thriving industry of cattle raising is noticeable.

Usually, a farmer keeps from 5 to 6 cattle which when not at work are turned loose on the fields. These are fed twice a day, morning and evening, and the feed consists of about 21.28 lb., + 5.32 lb., of mixed feed (" Kaoliang ", i. e. sorghum, beans and other similar feeds, mixed with cut straw or hay). In the working season they are fed twice more per day, at noon and in the evening. The straw fed is generally millet;

but wheat straw is also employed. In some places, dry peanut stems and sweet potato vines are used. As cattle for beef, Shantung breeds are far better than Korean or Mongolian cattle. At the time of the German administration in Tsingtau, distinct efforts were made to improve the cattle.

The methods of raising and feeding in Shantung are the same as those generally employed in the whole of China. The feed, however, differs according to the locality. In the Canton region the grain fed is usually cooked rice and wheat bran. The cattle in this region are not as large as those in Shantung; the average cow weighs 665 lb., the bull 1064 lb., and in exceptional cases have been noted to weigh as much as 1330 lb. when fat.

In southern China, the cattle consist of the so-called Zebus, but the hump and the fetlock are less developed compared with the Indian species; the females only have a comparatively insignificant hump.

The colour of the Chinese cattle varies from yellow red to a brown red and almost pure black; white and spotted cattle are rare because the meat in these two cases is considered inferior. The amount of milk obtained is so small, that the cows are seldom used for this purpose; the fat content is very high, varying from 5 to 8 %.

On the Hongkong market are found:— zebus from the region of Swatow (Kwangtung) much appreciated as beef stock. The second place is occupied by those from Wuchow and the third by those from Canton. Cattle are sold by the head, and not by weigt, at the rate of $28 to $50 (Mex.) for one zebu weighing from 600 to 800 lb.

The hills and mountain regions of China now being utilised only for wood fuel purposes will furnish sufficient pasture for at least wtice as many cattle as are being produced to-day in China. With the present prices paid for milk in this country (12 to 18 cents local currency per lb.) and for butter ($1.20 per lb.), there are few industries that offer better opportunities than the breeding of dairy cows.

The buffalo in China has been chiefly employed as a draft animal and later to be used for beef. In recent years in the south of China, the buffaloes have begun to be used for milk, and there have actually been cases of animals that give more than 12 lb., of milk per day, containing from 10 to 15 % fat. Six buffalo cows raised at the Canton Christian College have produced an average of more than 250 lb., of butter fat, during a complete lactation period.

Out of the 3 methods of cattle improvement namely: selection within the breed; mating with outside improved breeds; introduction of pure bred animals and continuing to breed them pure; the first method is safest, but a somewhat slow process. The crossing of the zebu with European breeds attempted in the Philippines and in India has not proved popular; the cross produces better beef cattle, but lacks the hump, which is so well adapted ior the yoke, and has less value for work purposes.

The introduction of pure bred European stock encounters numerous difficulties, especially with regard to sanitary conditions; if practised,

care must be taken not to introduce tuberculosis into China. The native cattle are highly resistant and some of the buffaloes are apparently immune to this disease.

CATTLE

891 – **Inheritance of Colour in Jersey Cattle.** (1) — HOOPER, J. J. in *The Journal of Dairy Science*, Vol. II, No. 4, pp. 290-292. Baltimore, July, 1919.

The author consulted the Registry books of the American Jersey Cattle Club, and tabulated the colour markings of 1145 calves male and female, and of their sires and dams. These indicated that the following were the dominant characteristics ; 1) solid colour over mottling ; 2) black tongue over white ; 3) black switch over white. There was a marked tendency towards the combination of the charcteristics solid colour, black tongue and black switch. The roan colour which was hitherto fairly common amongst Jerseys was apparently dominant to the ordinary colour.

892 – **Calf Feeding Experiments with Crushed Oats and Whole Oats.** — *Department of Agriculture and Technical Instruction for Ireland*, Vol. XX, No. 2, pp. 201-204, Dublin, 1920.

These experiments were carried out with a view to determining the comparative value of crushed oats compared with whole oats fed to calves in conjunction with separated milk. Previous experiments showed good results from a mixture composed of 1 part ground flax seed, 2 parts maize meal, and 2 parts oat meal. Variations were introduced later, in order to obtain a more economical mixture, In more recent trials, it was found that calves can be reared successfully by feeding the separated milk alone and supplying crushed oats and whole oats.

With the idea of controlling this method of feeding during 1918 and 1919, experiments were conducted at 21 centres. At each centre two lots of calves were selected of uniform size, and 1 lot was fed on separated milk supplemented with crushed oats, and the other on separated milk + whole oats. The total number of calves included in the test was 140 and the experiment extended over 122 days ; the average age of the calves at the commencement of the test was 6 ½ weeks.

Details regarding the live weight increase of both lots of calves on similar rations are given as follows :

Lot	No. of Calves	Average weight at beginning	Average weight at close	Average increase in 122 days	Average daily gain
		cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.
Lot I - Crushed Oats.	70	1 0 16	2 2 11	1 1 23	1.34
Lot II - Whole Oats	70	1 0 18	2 2 10	1 1 20	1.32

The difference in the results obtained from the 2 groups of calves is almost negligible, although there appears to be a slight tendency in favour

(1) See *R.* Jan., 1920, No. 81. (*Ed.*)

of the group which received crushed oats. At one centre only, the use of whole oats caused digestive troubles, and at another great difficulty was experienced in getting the calves to eat this food. When whole oats are fed to young calves, the quantity given at the commencement should not exceed 2 oz. per day, and should be increased gradually.

The following useful conclusions may be drawn : the cooking of meal is not necessary, and calves can be reared economically and successfully solely on foods produced on the farm ; where facilities are lacking for the crushing or bruising of oats, whole oats may be given instead.

893 - **Yield and Composition of the Milk of the Moroccan Cow.** — LEROY, A. (Préparateur de Physiologie, at the National Agronomic Institute), in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year IV, No. 30, pp. 177-186 + figs. 2. Paris, May-June, 1920.

In Morocco there are 1 200 000 head of cattle, among which we may reckon nearly 250 000 cows producing milk every year.

These animals, which are of small size (1.20 metres high at the withers), seem to belong to two distinct types, one with fawn coat passing into black towards the head and legs, with black muzzle, curved horns directed slightly upwards, and one with a straw-coloured coat, muzzle without pigment, white hoofs, lyre-shaped horns with white tips. In some districts (especially Meknès and Fez), there are piebald black and piebald fawn cattle with white patches limited to the abdomen and root of the tail. Most of the Moroccan cattle seem to be the result of the indiscriminate crossing of the first two types.

The author gives some details of the cattle breeding methods practised by the natives, and especially of the milking (the calf being allowed to take some of its mothers milk at the beginning and end of the operation).

The town herds are better tended and selected than the country ones.

The lactation period of Moroccan cows lasts about 9 months but in the case of exceptionally good cows, may last for 1 year). The milk yield of town-bred cows is on an average, 1400 kg per lactation, that of unselected animals bought at country markets may be as much as some 850 kg. Taking into account the amount of milk consumed by the calves, the milk yield of the town cows may be estimated at 1650 kg., and that of cows of rural origin at 1100. On an average 20.5 kg. of milk is required to obtain 1 kg. of butter fat.

Compared with the milk of French cows, that of the Moroccan cows has the same casein and lactose content, but usually is richer in fat-free extract and butter fat.

The milk of the Moroccan cow is more acid when first milked, than that of the French cow. For this reason, special care must be taken, if it is kept more than 12 hours, otherwise it coagulates on boiling.

The author concludes from his study that, under existing circumstances, it is best to use Moroccan cows, rather than imported French ones for supplying milk to the European customers in the towns, for

the imported animals are subject to tuberculosis and piroplasmosis, to both of which diseases the native cows are immune. By means of systematic selection, which is beginning to be practised by the natives, the author hopes that it will be possible before long to create herds of milch cows each producing, per lactation period, about 2000 litres of milk containing 4 % of fat. To effect this, it would only be necessary to supply the animals with food corresponding to thir live-weight and milk-yield, and to endeavour to prevent the calves sucking their dams during milking.

SHEEP

894 - **East Friesian Sheep at the Latium Stock-Breeding Station** (1). — Moreschi, B. in *Giornale d'Italia agricolo*, Year III, No. 25 p. 1., Rome, July 4, 1920.

With the twofold object of trying whether it was possible to acclimatise Friesian sheep to the Campagna Romana, and to cross them with Italian breeds, the Latium Stock-Breeding Institute bought, in 1916, 8 ewes and one ram of this German breed, celebrated for milk and wool production. In Friesia, the average milk yield of a ewe during a lactation period of 8 or 9 months is from 300 to 400 litres (some sheep give even as much as 6 or 7 litres of milk daily), while the annual yield of wool in the yolk is from 4 to 5 kg. Friesian sheep mature early and are very prolific; the ewes bear many twins (as many as 8 % of the flock), and sometimes three, four, or even five lambs are produced at a birth.

The results obtained from 1916 to 1919 are as follows:—

In 1916, the Friesian sheep gave birth to 6 ewes which produced 5 ewe-lambs and 3 ram-lambs; 1 male lamb and 2 ewes died.

In 1917 » » » gave birth to 5 ewes which produced 3 ewe lambs and 4 ram lambs: 3 male lambs and 1 ram died.

in 1918 » » » gave birth to 6 ewes, which produced 1 ewe-lamb and 7 ram-lambs; 2 ewes, 4 rams, and 1 male lamb died.

in 1919 » » » gave birth to 3 ewes, which produced 1 ewe-lamb and 4 ram lambs: 13 animals died.

Thus, at the end of 1919, there only remained 4 ewes, one of which afterwards died in lambing. This high mortality was due to the attacks of parasites. As the Friesian ram could no longer be used, a ram of the *gentile* breed of Apulia was mated with the Friesian ewes.

The high proportion of twin births, 3 out of 6 in 1916, 2 out of 5 in 1917, 2 out of 6 in 1918, 2 out of 3 in 1919, proved that the breed preserved its prolific qualities.

Prof. Giuliani, Director of the Latium Stock-Breeding Institute, stated that a Friesian sheep gave at the beginning of the lactation period 3 kg., of milk a day; this is much less than the usual yield in its own country. The milk of Friesian ewes reared on the Campagna Romana contains from 4.5 to 6.5 % of fat.

The amount of wool washed on the sheep by dipping in summer is, on an average, 2 kg., in the case of ewes, and 2.412 kg., in that of rams The average of the Latium flocks is 1.7 kg., per head. The wool of the

(1) See also *R.*, July-Sept., 1919, No. 953. (*Ed.*)

Friesian breed is of long staple, strong, rather elastic, but somewhat coarse, slightly and irregularly curled.

The Friesian breed maintained ther precocity in Latium ; at birth, the lambs weighed from 3 to 5 kg., and attained the weight of between 40 and 60 kg., in 6 months. At the age of eighteen months, the ewes weighed from 70 to 80 kg., and the rams 1 quintal, or even more. Cross bred lambs born as a result of the mating of Friesian ewes with the *gentile* Apulian ram, weighed at birth 3 to 5 kg., and after 8 weeks, 17.1, 20.4 and 21.9 kg., respectively ; their daily increase of weight being a little less than ⅓ kg.

From these results it may be concluded that the Friesian breed, which requires a damp and temperate climate, cannot be acclimatised in Latium, and under the unfavourable conditions prevailing there, it soon loses its characteristics.

If, however, breeders giving up the idea of rearing pure bred stock, would cross Friesians with the native races, they would doubtless achieve good results as regards milk-yield and size, and perhaps increase the productivity of the Italian sheep.

895 – **Beet Pulp for Fattening Lambs.** — LEADLEY, T. A.; in *The Nebraska Farmer*, Vol. 62 No. 14, p. 994. Lincoln, Nebr., April 3, 1920.

A ration of alfalfa, hay, dried hay, beet pulp, cottonseed cake and silage, produced the largest gain and returned the most profit on a lot of 31 lambs in a 100 day feeding experiment with 12 different rations, recently completed at the Scottsbluff Experiment Station.

Lot Number and Ration.

	1	2	3	4	5	6	7	8	9	10	11	12
	Hay Maize	Hay Maize CSC*	Hay Dried Pulp Maize	Hay Dried Pulp CSC* Maize	Hay Dried Pulp	Hay Dried Pulp CSC*	Hay Dried Pulp CSC*	Hay Dried Pulp CSC* Silage	Hay CSC* Silage	Hay Maize Beet Tops	Hay Dried Pulp CSC* Beet Tops	Hay CSC* Beet Tops
Average daily gain per lamb	.313	.388	.299	.381	.298	.375	.396	.421	.245	.375	.403	.245
Pounds feed per 100 lbs. gain per lot:												
Hay	503	408	547	396	482	416	452	235	485	391	350	630
Maize	306	246	107	84	—	—	—	—	—	255	—	—
CSC*	—	76	—	77	—	79	104	70	120	—	73	120
Dried Pulp	—	—	224	175	328	261	242	231	—	—	242	—
Silage	—	—	—	—	—	—	—	417	719	—	—	—
Beet Tops	—	—	—	—	—	—	—	—	—	1.63	1.71	2.99
Cost of feed per 100 lbs. gain $	12.89	13.62	11.39	11.93	9.59	11.26	12.36	10.57	11.86	12.16	11.85	13.13
Appraised value per 100 lbs $	17.50	18.00	17.75	18.00	17.65	17.90	18.00	18.10	17.00	17.75	17.85	17.25
Net profit per lamb. $	1.83	2.32	2.40	2.94	2.91	3.02	2.87	3.80	1.50	2.59	2.95	1.34

* CSC = Cottonseed Cake.

The following points are outstanding from the detailed results given in the above table: Dried beet pulp when properly supplemented with alfalfa hay and cottonseed cake is an excellent feed for fattening lambs. Cottonseed cake added to the ration at the rate of one-third pound per lamb daily in every case increased the daily gain and the net profits.

Silage added to the ration of hay, dried pulp and cottonseed cake increased the daily gains, lowered the cost of gains and increased the net profit per lamb. Beet tops added to hay and maize ration produced gains at a lower cost, and increased net profits. Beet tops added to hay, dried pulp and cottonseed cake ration increased the daily gain slightly, increased the cost of gain and decreased the net profit. Lot 7 shows an increase in the amount of cottonseed cake from ⅓ to ½ lb. per lamb daily.; slight increase in gain, but increase in cost of gains and lowering of net profit.

GOATS

896 – **Goats and Levroux Cheese.** — Bonafé, A. (Directeur des services agricoles de l'Indre), in *La Vie agricole et rurale*, Year 3, No. 42, pp. 276-277, figs. 2. Paris, October 18, 1919.

The goat plays a very important part in the rural economy of the Department of Indre. It is found more or less everywhere, but most frequently on the limestone plains of Champagne, where it takes its place beside the sheep, large flocks of which belong to the large estates. Goats to the number of 5, 10, 15 or rarely 20 heads, are, however, kept by the owners of small holdings, and by agricultural labourers. The goat is *par excellence* the animal of the poor as it can be managed by the family without any outside help, and is a source of considerable profit.

It is of average size; its coat is usually brown with white at the extremities; on the forehead is a brown stripe, that finishes at the muzzle, and has wide white borders; horns are as a rule absent; beards may be present or absent (very variable).

Mated with the ram on November 1, the females give birth, at the beginning of April, to two kids, which they suckle for a fortnight; the kids are then sold, and the milk is used for cheese making. Kids kept for breeding are reared with the bottle and cows milk.

During the winter, the animals remain at the sheep-fold; their rations are composed of bran, dry forage, and a mash consisting of bran, beetroots, and boiled potatoes.

In summer, after a small ration of forage and bran, which they eat at the farm, the little herd is driven to the fields by the old men or the quite young children of the family, who are helped by a well-trained dog. The goat browses on the sainfoin aftermath, or that of temporary pastures; it requires succulent appetising food, and is not content with the meagre pasturage that suffices for sheep.

Milking is done twice a day, morning and evening; on exceptional occasions, the goats are milked a third time, at midday.

The milk yield is rather small after the first time of kidding (this takes place when the goat is about 14 months old), but it attains its nor-

mal amount after the goat is 3 years of age. From this time, the animal gives at least 1.5 litres daily for 7 months (May to December); this would mean a minimum of 210 cheeses per annum (allowing 1.5 litre of milk for each cheese). When its milk-producing power decreases, towards the age of 9 to 10 years, the goat is no longer kept, but is sent to the butcher.

After each milking, the milk is put into earthenware vessels, taken to the cellar, and as soon as it is cold, the rennet is added. For 1 litre of milk, is used a piece of solid rennet the size of a pea, which is specially prepared by the pharmacists and grocers of the district. The curd forms in 24 hours in summer and in 48 in winter. It is placed to drain in a form or cheese-basket that gives it the shape of a truncated pyramid, with a square base. The curd is put into the form by degrees, a little at a time, and no small amount of dexterity is required to ensure a homogeneous paste. The cheese takes one day to drain ; next day, the exposed surface is salted, and the following day, it is taken out of the form and salted all over. When covered with salt, the cheeses are put on a layer of straw in a large wickerwork basket, and hung up in a well-ventilated room, where they can dry and acquire the proper consistency, or else they are put on a wire-stand with compartments and placed in the garden. The farmers wife turns the cheese every day, placing the bottom surface uppermost.

After a week, the blue mould begins to make its appearance on the surface of the cheese, and develops more or less rapidly according to the surroundings. Sometimes it is necessary to remove the cheeses to a damper place, and to wrap them for some hours in damp cloths.

The making of these cheeses is not regulated scientifically; after some experiments, the most favourable conditions are found out.

A week after the appearance of the first blue specks, the fungus mycelium is fully developed, and the cheese is ready for sale. It is not, however, fully ripe, but this is the best time for transporting it; the rest is left to the consumer or cheese-monger. The cheeses are ripened by being placed in earthenware receptacles that are first covered with a cloth and later closed. In this new enviroment with limited air and a high degree of humidity, the mucidineae grow more slowly, whereas the bacteria show great activity, the paste gradually becomes oily, and the flavour develops. The process is permitted to continue for a longer or shorter time according to the wishes of the customer.

When well-made, Levroux cheese is one of the most highly prized goat cheeses. Its fame exceeds that of the Berry variety, it figures largely at the Paris restaurants, and the demand for it cannot be adequately satisfied.

It is estimated that there are 40 000 goats in the Department of Indre, and that an average of 9 million cheeses are produced annually. In reality, however, more cheeses are made, for not infrequently, cows milk is used to dilute the goats milk to a small extent.

The best cheeses come from Vineuil, Levroux, Brion, Brittany, and Champenoise, where there are great plains covered with sainfoin which forms the staple food of the goats.

As soon as the animals are put out to grass, or to brouse on the leaves of the trees, the quality of the milk becomes inferior. The prices of the goat and its products during the pre-war period and at the present time are as follows:

Milk-yielding goat	35	80 to 100
Dry goat	5	15 to 20
Kids	4 to 7	10 to 30
White cheeses (salted and dried)	0.30	1
Blue cheeses (covered with mould)	0.35	1.20
Ripe cheeses (finished in earthernware pot)	0.45 to 0.50	1.50

These figures would give a gross return of 250 to 300 fr. per head: this means a high profit. It must, however, be remembered, that goats need liberal feeding, careful supervision, and unremitting attention, which if adequately recompensed, would mean a considerable outlay.

897 - **An Experiment with Fattening Pigs to Compare Cooked with Raw Potatoes.** — *Department of Agriculture and Technical Instruction for Ireland Journal*, Vol. XX, No. 2, pp. 190-193. Dublin, 1920.

PIGS

The high cost of fuel, of manual labour, etc., has been the reason why many farmers hesitate to undertake the fattening of pigs with cooked food, especially potatoes, which however is a customary proceeding in Ireland. The Department of Agriculture has therefore undertaken a series of tests in order to ascertain if it is possible to fatten pigs successfully on a diet of raw potatoes. These tests were carried out at 5 centres, and at each centre the pigs were divided into 2 lots, as for as possible homologous in appearance, and the total number of pigs was 34. The average age of the pigs at the commencement of the tests was 15 weeks and the tests covered a period of 110 days.

Lot I were given cooked potatoes; Lot 2 raw pulped potatoes. In all other respects the two lots were treated alike The 2 lots consumed the same quantity of feed, and particulars regarding the live weight increase are given as follows:

Lot	Number of pigs	Average weight at beginning	Average weight at close	Average increase	Average Daily Gain
		cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	lb.
Lot 1 (cooked potatoes)	17	— 3 2	2 0 20	1 1 18	1.43
» 2 (raw potatoes)	17	— 3 4	2 0 6	1 1 2	1.29

Results show that the 17 pigs which received cooked potatoes made an increased gain in live weight of almost 16 lb. per head (equals a total gain of 266 lb.) as compared with the 17 pigs which received raw potatoes. Naturally, against the pigs which were fed on cooked potatoes must be set the cost incurred in cooking the latter. Nevertheless, taking into account the market conditions when the experiment was made, the value of the increased live weight was obviously superior to the expenses in-

curred in cooking the potatoes, and the following conclusions may be drawn:

(1) At the present price of pork, a substantial profit is obtained by the cooking of potatoes for fattening pigs.

(2) Moderately good results may be obtained from the use of raw potatoes; but in this case the fattening period is extended.

898 – Effect of Calcium on the Composition of the Eggs and Body of Laying Hens. POULTRY
— BUCKNER, G. D., and MARTIN, J. H., in the *Journal of Biological Chemistry*, Vol. XLI, No. 2, pp. 195-203. Baltimore M. D., Feb. 1920.

The authors have determined the effect produced by grit, oyster shell, and limestone, fed with the ordinary ration used for laying hens; and also the ultimate effect on the constitution of the hen, of the continued laying of eggs in the absence of calcium other than that contained in the food.

Four lots of 10 white Leghorn pullets each received the same ration, namely: 1) a dry mash composed of 6 parts maize meal + 3 parts bran + 3 parts middlings + 5 parts meat meal + 4 parts charcoal; 2) a grain mixture of 16 parts wheat + 16 parts cracked maize + 8 parts oats. These foods were supplemented: in Pen 2, with grit; in Pen 3 with grit and oyster shell; in Pen 4 with grit and limestone; Pen 1 served as a control test. The experiment extended over 6 months.

A series of Tables shows: 1) the analyses of the materials fed, the mortality and egg record; the analyses of shells of eggs from the various pens; the analyses of the contents of eggs from the various pens; the analysis of a anormal hen compared with that of a hen in Pen 2 that had collapsed and died; the analyses of carcasses and leg bones of hens from all lots, at the end of the experiment.

From a study of these figures the following conclusions may be drawn:—

(1) Laying hens whose supply of calcium is limited to that naturally contained in the food, continue laying until there is a general depletion of magnesium, phosphorous, and calcium in their bones and carcasses.

(2) As long as the hens permit the formation of an egg shell, the contents thereof remain reasonably constant, thereby allowing an average supply of calcium, magnesium and phosphorous sufficient for the normal development of the embryo of the chicken.

(3) Ten weeks elapse before there is any noticeable change in the general condition of hens receiving no mineral matter other than those naturally contained in the food ration such as that fed during these experiments.

(4) The lack of calcium is not the fundamental cause of the formation of shell-less eggs.

(5) The percentages of calcium and phosphorus in the bones of the hens in all lots were fairly constant, thus indicating a stable equilibrium between the 2 elements.

(6) The continued laying of eggs taking into account the calcium restrictions, does not materially alter the percentage mineral composition of the egg shells or their contents. There is, however, a gradual thinning of the shell.

(7) Under the conditions governing this experiment, the addition of limestone or oyster shell to the ration, increases the production of eggs 69.4 % as shown by the average production of Pens 1 and 2 when compared with that of Pens 3 and 4.

BEE-KEEPING

899 – **Bee-Keeping in Isolated Hives.** — ROBERT-AUBERT, in *L'Apiculture*, Year 64, No. 7, p. 155. Paris, July, 1920.

Bee-keepers, whose stock is attacked by foul-brood, are usually those who take their honey too early and use composite hives arranged in such a way that they always obtain relatively large quantities. Taking the honey and replacing the frames of these hives for the bees to clean are two operations that encourage the queen to lay at the very time when she ought to be prevented from so doing. If the honey supply continues, no harm is done, but if the honey-season is finished, which is generally the case in districts where foul-brood is rife, there is a great risk that the bees seeing their emptying frames, will let part of the brood die on account of want of honey.

The author has substituted for this pernicious system one which 25 years' experience has proved most satisfactory. He uses LAYENS hives with 20, 22 and 25 frames. In May, he pays his first visit, cleans the hives, divides any food that is left, and replaces useless frames wih sections containing bees-wax. Having done this, he does not open the hives again until after September 1, unless the season is a good one, in which case, he visits them again, to take the honey from the side opposite the brood. This operation takes place once every 3 years. In September, he removes the superfluous honey, and as the bees only concern themselves with the part of the hive where they are going to winter, this hardly disturbs them at all, and the replacing of the frames to dry only gives them one day's work.

The result of 25 years' bee-keeping with isolated hives according to this simple method is that the honey supply has never failed and the author has taken honey every year. The average yield in Oise during these 25 years was from 22 to 25 kg., per hive per annum. His great triumph is that, even in bad seasons, it has never been necessary to feed the bees. The latter were thus allowed to live naturally, they received no food, the brood did not die, and there were no signs of foul-brood.

M. ROBERT-AUBERT is of opinion that if all bee-keepers followed his example, many more hives could be kept and much larger quantities of honey obtained without losing the brood. Bee-keepers who take too much honey, whose broods, die, and who are obliged to feed their bees on a large scale every year, are evidently in the wrong.

SERICULTURE

900 – **Crossing Experiments with Varieties of Silkworm Having Bivoltine Females.** — PIGORINI, L. (R. Stazione bacologica sperimentale at Padua), in *L'Italia agricola*, Year 57, No. 5, pp. 129-146. Piacenza, May 15, 1920.

Breeds used in the experiments. — The following 19 crosses were made:

Small, bivoltine, greenish-white female with males of an annual breed viz., golden Chinese, white Japanese, yellow Ascoli and yellow Gran Sasso.

White bivoltine female with annual males, viz., white Japanese, and yellow Gran Sasso.

White, bivoltine female with gibbous caterpillars with annual males, viz., golden Chinese, white Japanese, yellow Ascoli, and yellow Gran Sasso.

White, bivoltine Chinese female with annual males, viz., golden Chinese, white Japanese, and yellow Ascoli.

Mixed white bivoltine female with annual males, viz., golden Chinese, and white Japanese.

Yellow bivoltine female with annual males, viz., golden Chinese, white Japanese, yellow Ascoli, and yellow Gran Sasso.

The results of the crosses were studied in 101 small separate rearings, each lot consisting of hybrids from the same laying.

Objects of the experiments. — The characteristics of the cocoon were investigated in these researches. The weight dimensions, form, amount of silk and its properties were all studied.

The number of cocoons examined were :

for total weight	15 173	cocoons
for size and shape	2 474	»
for weight of outer silk and fibrin	1 479	»
for length of reelable silk and standard	1 082	»
for strength and elasticity (3 597 determinations)	351	»

The technique of the various determinations has been improved by the author.

Results. — These are given in a series of tables and summarised as follows :

In addition to the well-known fact that in crosses made with a bivoltine, female bivoltism persists in all cases, the hybrids obtained by the author showed parental characters as well as intermediate and non-intermediate characters.

Of the intermediate characters, some occurred according to the average number calculated, others deviated from it more or less, sometimes approaching nearer to the paternal or maternal characters respectively.

The non-intermediate characters have slightly higher values than those of the parents, but smaller values.

The observations may be arranged in a schematic form as follows :

A. — Intermediate Characters.

(a) *Attaining the average.*

I. — *Size.* This was calculated by determining the long diameter. The calculated average was 177 ; the average ascertained was 176. Partly by means of the observation of the calculated averages and the averages found, and partly by noting the slight deviations of the latter from the respective averages, the author concluded that the phenomenon was constant.

He mentions special cases of crosses with a golden male, in most of which the dimensions of the hybrid are not intermediate, but exceed those of the parents.

II. — *Shape.* The method employed, which consists in indicating the size by a sign or a series of numbers that express the ratio of the diameters, necessitates the separate consideration of crosses between more or less strangled cocoons, or between strangled and non-strangled cocoons, such as in the present case, where a golden Chinese male was used. In both cases, the value found coincided with the average calculated values.

III. — *Percentage of crude fibrin in the raw silk.* As a rule this amounts to 101 % of the general calculated average. This figure remains approximately the same in all the groups. Mention, however, should be made of the case of crosses with a Japanese male, in which the percentage often exceeds the calculated amount, and in most cases exceeds the fibrin percentage of the parent producing most fibrin.

IV. — *Standard of the thread.* Taking this as a whole, it may be said that the standard proved to be 99 % of the average calculated, that is to say it coincided with it. It should, however, be observed that crosses with Eastern breeds slightly lowered the standard, while crossing with local breeds raised it.

(b) *deviating from the average.*

(b_1) *below the average*, inclining towards the maternal characters.

I. — *Weight of outer silk.* This is much below the calculated average, being only 77 % of the latter. This inferiority is constant and is found however the crosses are arranged. The character thus tends to approach the maternal character, and it is permissible to suppose that the latter is dominant as regards the paternal chracter. It must, however, be remembered that the breeding conditions may have exerted some unfavourable effect.

II. — *Length of reelable silk.* Taken as a whole, the value found was 83 % of the calculated value. For the rest, what has already been said about the weight of the outer silk holds good here also. This character may be regarded as depending on the previous one.

(b_2) *above the average*, and tending towards the paternal character.

I. — *Strength of thread.* This is 111 % of the calculated average. This phenomenon is constantly observed in all the hybrids.

B. — NON-INTERMEDIATE CHARACTERS.

(a) *superior to the characters of each of the parents.*

I. — *Elasticity of thread.* — This is observed in the majority of cases and always in partial groupings. It may further be said that the arrangement of the groups of hybrids according to the degree of elasticity of the thread follows the order of the females as regards this character, which shows the special influence of the females.

(b) *superior to the characters of the parents and approaching their sum.*

I. — *Colour.* — Taking the total of the cases studied, this attained 84 % of the sum of the parents' character. The order of the succession of the groups of hybrids according to colour, does not reproduce that of their parents. It is not possible to speak with the same certainty as has been done for the characters previously described, with regard to various other characters such as *vigour of larvae, live-weight of cocoons,* and *the num-*

ber of double cocoons. The author is, however, able to state that the hybrids are chiefly affected by the vigour of the bivoltine race ; that the live-weight of the cocoons largely depends upon paternal influence, seeing that it was greater when the females were crossed with local males than when the male parent belonged to an Eastern variety. The occurrence of double cocoons was clearly reduced to one-half (from 12.9 to 7 %) by crossing with an annual race.

VARIOUS ANIMALS

901 – **Note on the Description of Elephants.** — SCHEIN (First-Class Veterinary Inspector), in the *Bulletin économique de l'Indochine*, Vol. XXIII, New Series, No. 140, pp. 26-41, + figs. Hanoï-Haïphong, Jan.-Feb., 1920.

Few authors have written about elephants, and so far Veterinary Captain EVANS is the best authority. In addition he has had the advantage of studying and writing about the elephants of Burma, which largely come from South Indo-China, Cambodia, and South Annam, and are thus the brothers of those examined by the author. But he has not given a method by which elephants may be described, and the author has filled in this blank by the article under consideration.

The primitive races Moïs and others, could recognise an elephant after not having seen it for a very considerable time, but they could not give an accurate description of it. The author has followed the standard method of listing the points of a horse. viz : — Stud number and mark, name, sex, skin and colouring, shape, head (nose, teeth, skull, ears), back, tail, legs, hoofs, height, age, special points (approximately: very young, young, adult, old, very old). The author describes these points in detail, and gives numerous illustrations. In addition, he gives a sample of a scoring card for elephants, and diagrams of an elephant and the chief parts, all of which will greatly simplify descriptive work in this connection.

902 – **Domestication of the African Elephant in the Belgian Congo, (Api Station)** (1) — LEPLAE, E., in *Bulletin agricole du Congo Belge*, Vol. X, Nos. 1-4, pp. 207-269, figs. 10. Brussels, March-December, 1919.

The Indian or Asiatic elephant (*Elephas maximus*) seems to be descended from the mammoth (*E. primigenius*), whereas it is supposed that *E. antiguus* was the ancestor of the African elephant.

Although there is probably only one species of elephant in Africa, a certain number of varieties, or sub-species, differing chiefly in the shape of their ears, have been found in that continent.

These varieties, according to the publications of the British museum of Natural History, are as follows :— (1) The Cape elephant (*E. Africanus capensis*) ; (2) the western variety of the Cape elephant (*E. a. toxotis*) ; (3) the Matabeleland elephant (*E. a. Selousi*) ; (4) the West African elephant (*E. a. cyclotis*) ; (5) the elephant of the Masaï (*E. a. Knochenhaueri*) ; (6) the Aberdare elephant (*E. a. Peeli*) ; (7) the Lake Rudolph elephant (*E. a. Cavendishi*) ; (8) the Abyssinian or E. Sudan elephant

(1) See *R.*, May, 1919, No. 633. (*Ed.*)

(*E. a. oxyotis*); (9) the elephant of N. Somaliland (*E. a. Orleansi*); (10) the W. Sudan elephant (*E. a. Rotschildi*). In the British Museum Handbooks the dwarf Congo elephant (*E. a. pumilio*) and the Lake Albert elephant (*E. a. albertensis*) are also mentioned.

In the Belgian Congo, there are various zoo-geographical regions, hence it is natural that different races of elephants should exist in the country. Hitherto, however, it has not been possible to determine them accurately, owing to the necessary documents being somewhat difficult to obtain. It is the same in all the other African Colonies, and the elephants there have been relatively little studied.

The race living in the Lower Congo is most likely, according to M. Schouteden, *Elephas africanus cyclotis*. It is hoped that, before long, an opportunity of verifying the matter will present itself.

In the North of Uelé, the Sudan elephant (*E. a. oxyotis*) is found. *E. a. Cottoni* lives in the great forest and in Ituri, while near Lake Albert, and as far as Semliki, *E. Albertensis* is met with; this is probably the same race as that found near Lake Edward.

At Katanga, there is a variety of which little is known as yet. It is not possible at present to identify it from museum material. The circumference of one of the fore-feet of an adult elephant killed in 1912, near Nieuwdorp was 1.26 metres, which corresponds to a height of 2.52 m. at the withers.

A very large elephant has been found near Lake Leopold II; its skull, which is a magnificent one, is at Tervueren, but fresh material for study is awaited. Besides this giant race, there is also a dwarf variety, *E. a. Frausseni*, which lives in herds. Another variety of elephants, a half-dwarf one, lives near Lake Albert; in 1916, the author had a male and a female specimen shot for the Museum of Tervueren.

The author deals successively with the following matters: Trade in elephants in Burma, their classification, food, diseases (pnemonia, colic, cerebral congestion, heat-apoplexy and sun-stroke [the elephant being by nature a nocturnal animal, cannot stand very high temperatures well]; anthrax, trypanosomiasis, a common disease in Burma which does not seem to occur in Africa; piroplasmosis, rare; apthic stomatitis; tetanus and tuberculosis, rare; the elephant seems immune to rinderpest); the capture of elephants in British India (the author describes a hunt in which he took part in Ceylon in 1910, when 17 wild elephants were captured).

When the Api elephants are not working, they spend their day in the following manner. They go out to feed at 5 in the morning, each accompanied by a driver, and return about 5.30 p. m., when they are given a little manioc, some potatoes, and a bunch of bananas.

On working-days, they begin their labours at 4 a. m. and if they have to go far, to fetch tree trunks for instance, they set forth at midnight, or at 1 or 2 in the morning. In any case, the elephants stop working at 11 a. m., rest, bathe, and then graze all the afternoon.

The elephant-hunts, which were interrupted in 1914 by order of Commissioner BERTRAND, used to last 2 months at a time, 3 elephants about 1.60 m. high being captured. The captives are allowed one year to get accustomed to their new conditions, and then trained for 10 to 12 months, when they are put to work with the others.

In 1918, Lieut. MAGNETTE drove a cart with 6 elephants to Buta and back. The 700 kilometers were accomplished without accident, but not without difficulties. There would be no trouble in using elephants outside the Station of Api, provided they were gradually accustomed to the new surroundings and persons.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

903 - **Continuons Knife Mowers.** — LARUE, P., in *La Vie agricole et rurale*, Vol. 9, No. 19, pp. 331-335. Paris, May 8, 1920.

The mower knife works with an interrupted movement, the grass being cut by the action of the blade edge passing between the teeth of the comb. The action is similar to that of pruning shears, and needs more power and is not as clean as that of the double-blades of garden shears or tinman's sheard. But a satisfactory movement of the blades of shears in the grass is not practicable.

M. J. d'HEUR, of Daubs (France), has evolved a set of continuous action shears. To do this, he replaced the toothed cutter by a blade having steel teeth set "en échelon" and with vertical cutting edges. Two blades, moving in opposite directions one over the other, act as clippers, cutting the grass.

Continuous movement is obtained by using an endless steel band, a sort of bandsaw whose parallel blades move in the space between the combs used in the machine. The band passes over a small pulley at the end of the knife blades and is actuated by another pulley driven off the road wheel of the machine.

A lateral roller assures the stability of the machine.

A single driving wheel is found to be very efficient and does away with the need for a differential.

904 - **A Seated Drag-Hoe** — LARUE, P., in *La Vie agricole et rurale*, Vol. 9, No. 19, p. 333. Paris, May 8, 1920.

In classical machinery for cultivating the soil, the working parts slid through the earth, the machine was carried on wheels and the driver walked behind.

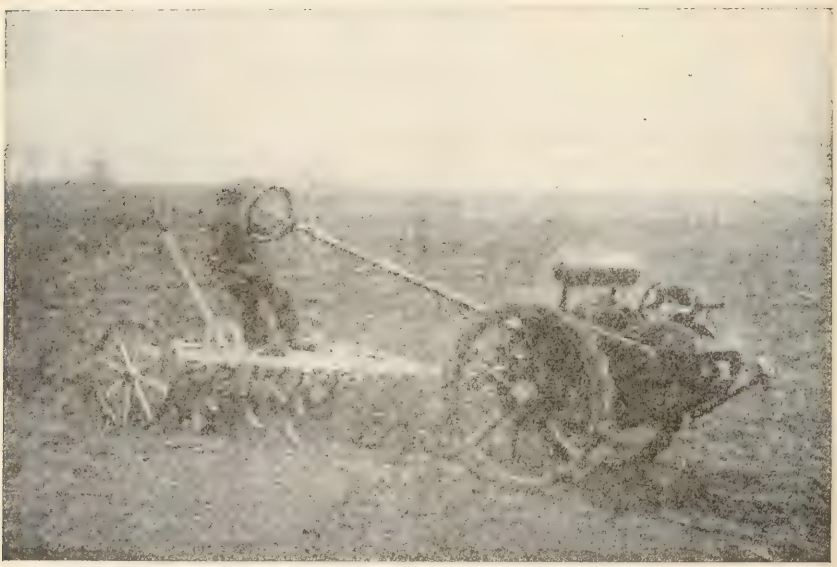
M. BAILOR has constructed a tillage machine in which the working parts rotate, the supports slide and the driver sits.

The whole machine representers a small disc harrow mounted on 2 runners with a steering runner behind. The depth is regulated by means of a lever held by a ratchet.

Oblique weeder blades in front give stability and prepare the work for the discs.

905 – **The Blanchard Improved Fore-Carriage.** — DESSAISAIX, R., in *Journal d'Agriculture pratique*, Year 84, No. 22, p. 411. Figs. 1. Paris, May 27, 1920.

The first model of M. BLANCHARD'S double brabant plough was actuated by a motor and two windlasses fixed over the back axle (1), but many improvements and alterations have been made in the latest design of machine put on the market under the name of the *Agro* (90, Rue Saint-Lazare, Paris, 9e).



BLANCHARD Improved Fore-carriage.

The appended figure gives a general idea of the machine working as a fore-carriage tractor, pulling a flexible-toothed cultivator provided with a driving seat and all controls.

When pulling, the motor actuates the two driving wheels, whose tires are provided with grips.

This machine is capable of hauling : — An 11 toothed cultivator, a 60 toothed harrow with roller, a mowing machine having a 1.5 m. blade, a binder or a double brabant for light ploughing and stubble skimming.

The single cylinder motor (bore 96 mm. × stroke 120 mm.) develops 8 HP. at 1400 R.P.M. The cylinder is ribbed and is air cooled by a rotary fan. A pulley is provided so that other machines may be driven by belt.

(1) See *R.* March, 1918, No. 333 (*Ed.*).

The wheels are 90 cm. in diameter, and the tyres are 0.8 cm. wide The track can be increased from 70 to 80 cm.

With the windlass a cable 5 cm. in diameter is used, having a breaking strain of 1500 kg. Each windlass holds 250 m. of cable whose anchorage to the ground is maintained by a chain 8 m. long. held by 6 iron pegs. Using the cable, the speed is about 2 m. p. h., and working as a tractor from 2 1/4 to 2 1/2 m. p. h. (reverse 1 1/2 m. p. h.), depending on whether the diameter of the wheels is increased by the grips or not.

906 – **A Turbine Sorter for Seeds.** — See No. 859 of this *Review*.

RURAL ECONOMICS

907 – **Research Work of the Swiss Peasants' Secretariat on the Swiss Agricultural Yields from 1914-1918.** — *Schweizerische Landwirtschaftliche Zeitschrift*, Year 47, Part 11, pp. 215-216; Part 13, pp. 267-268; Part 16, pp. 350-351; Part 20, pp. 435-437; Part 45, pp. 992-994; Part 46, pp. 1006-1008; Part 47, pp. 1033-1034; Part. 48, pp. 1049-1050; Part. 49, pp. 1079-1080. *Cf.* also *Untersuchungen betreffend die Rentabilität der scheweiz. Landwirtschaft, Bericht des schweizerischen Bauernsekretariates an das schweiz. Landwirtschaftsdepartement, Erntejahre* 1915-1919, Vols. 30-33. Berne, 1916-1919.

The *Review* of January, 1916, under this heading, contained several extracts from the 16th. Report presented by the Swiss Peasants' Secretariat to the Swiss Department of Public Economy. The present study reviews briefly the principle distinctive economic results that characterise the yields obtained by Swiss Agriculture during the war, in comparison with preceding seasons.

VARIATIONS IN THE GROSS YIELD PER HECTARE OF CULTIVATED LAND IN THE LAST FOUR SEASONS. — Table I gives the chief data relating to the average gross yield per hectare worked out in figures for the investigation farms whose accounts were audited by the Swiss Peasants' Secretariat for the period March 1, 1914 to February 28, 1915, and March 1, 1917 to February 25, 1918.

In order to summarize the results, the general averages of 288, 259, 200, and 253 farms for the years 1914-15, 1915-16, 1916-17, 1917-18, respectively are shown in Table I.

The influence of the size of these farms on the gross yield is remarkable. It will be of interest to give in Table II, in order to complete the analytical data of Table I, the results in round figures of the gross yields per hectare, in order of importance, obtained during the four years investigated. As can be seen in Table I, the noteworthy increase in gross yield per hectare during the war should be attributed to nearly all the productive branches of the farm, but in different degrees.

The increase of cultivation depends in the first place on the greater stocks of cereals, potatoes and forage present on the farm during the successive years.

TABLE I. — *Variations of the gross yield per hectare during* 1914-15, 1916-17, 1917-18 *on Swiss farms audited by the Swiss Peasants' Secretariat* (1).

Productive branch of the farm	1914-1915 Average of Farms 288			1915-16 Average of Farms 259			1916-17 Average of Farms 300			1917-18 Average of Farms 353		
	Gross yield per hectare cultivated	Gross percentage yield	Increase in Percentage	Gross yield per hectare cultivated	Gross percentage yield	Increase in percenage	Gross yield per hectare cultivated	Gross percentage yield	Increase in percentage	Gross yield per hectare cultivated	Gross percentage yield	Increase in percentage
	fr.	%	%	fr.	%	%	fr.	%	%	fr.	%	%
Advancesis crops	35.75	4.56	+ 26.63	21.70	2.31	+ 3.45	32.53	2.97	+ 6.49	46.98	3.34	+ 4.84
Sale of eereals	17.86	2.28	—	29.29	3.12	+ 5.52	36.69	3.34	+ 4.71	56.22	4.00	+ 6.34
Sale of potatoes	18.12	2.32	—	28.97	3.08	—	3615	3.30	+ 4.57	57.05	4.06	+ 6.78
Fruit growing	80.68	10.29	+ 76.06	85.37	9.08	+ 15.74	92.24	8.41	+ 4.02	178.37	12.70	+ 27.60
Forestry	19,76	2.52	+ 4.51	22.34	2.38	— 0.60	38,38	3.50	+ 10.20	53.28	3.79	+ 4,83
Cattle breeding.	130.33	16.62	+ 29.23	199.40	21.23	+ 45.92	278.66	25.40	+ 50.42	305.21	21.72	+ 8.61
Dairy-farming	293.19	37.39	— 30,79	307.62	32.73	— 9,05	327.91	29.89	+ 12.91	375.98	26.75	+ 15.59
Pig breeding.	56.20	7.17	— 9.07	79.82	8.49	+ 10.38	91.93	8.38	+ 7.70	129,25	9.20	+ 12.12
Other souces of receipts. . . .	132,19	16.85	+ 12.43	175.31	17.58	+ 28.64	162.54	14.81	— 1.02	203.00	14.44	+ 13.29
Total gross yield . . .	**784.08**	**100.00**	**100.00**	**939.82**	**100.00**	**100.00**	**1097.03**	**100.00**	**100.00**	**1405.34**	**100.00**	**100.00**

(1) In this table and in the rest of the article, values are given in Swiss Francs. (*Ed.*)

TABLE II. — *Variations in gross yield per hectare of cultivated ground obtained for farms, with accounts audited by the Swiss Peasants' Secretaria and classified in their order of importance during the years* 1914-15, 1915-16, 1916-17, 1917-18.

Year	Farms of 3-5 hectares	Farms of 5-10 hectares	Farms of 10-15 hectares	Farms di 15-30 hectares	Farms of more than 30 hectares
	fr.	fr.	fr.	fr.	fr.
1914–1915	1 021.62	828.64	771.63	659.45	616.58
1915–1916	1 164.84	1 001.98	916.94	805.99	742.15
1916–1917	1 285.52	1 130.00	1 077.06	1 026.07	856.46
1917–1918	1 734.32	1 518.48	1 284.17	1 239.12	1 021.56

There is, in addition to this a constant increase in receipts obtained from the sale of cereals and potatoes. The receipts brought in by fruit farming per hectare is noteworthy, and is mainly due to higher unit prices.

It is also interesting to note the increased receipts produced by the forests ; the average, and large peasant farms with a considerable wooded area benefited most from this increase.

In Table III the results obtained from the Cattle rearing are examined in detail in order of size and compared with the pre-war results.

TABLE III. — *Gross yield from cattle-rearing per hectare on various farms arranged in order of importance.*

Year	3-5 hectares	5-10 hectares	10-15 hectares	15-30 hectares	more than 30 hectares	Average
1908	156.50	96.24	100.70	71.08	45.05	94.25
1912	234.76	147.15	126.71	113.23	94.45	141.84
1914	196.81	133.86	117.80	116.64	108.31	130.33
1915	274.23	209.48	186.02	176.86	152.88	199.40
1916	360.30	293.51	251.24	254.85	221.43	278.66
1917	197.80	149.54	131.47	122.88	99.73	142.08
Media	367.01	335.94	279.46	254.08	241.82	305.21

The increase in receipts from cattle breeding is explained by the increased unit prices and by more intensive breeding and by a rapid influx of fresh animals and elimination of the older ones.

In the two last years, the increase of the gross receipts from dairy farming is noteworthy, although they decreased from 1912 to 1914. Milk production diminished chiefly on account of the unit prices of the last 2 years, which prevented this productive branch of Swiss agriculture from contributing enough to increase the production per hectare.

Pig breeding which suffered a decline in 1914, because of the lack of concentrated food, has again developed during the following years and, especially in the last one, has contribued greatly to increase the gross receipts per hectare.

PRODUCTION FOR HOME AND MARKET. — Production for the home and market during the war, was particularly interesting for it shows up the efforts made by the producers to supply the demands of the market.

A considerable part of the yield was thus absorbed by the market, whilst that taken for home consumption, although showing a large increase mainly due to increased unit prices, was not wholly as important as that absorbed by the market. This increase naturally varied with the different products, and also for the different classes.

Table IV gives the averages for all the farms investigated during the years in question.

TABLE IV. — *Production, domestic consumption and the market during the war per hectare cultivated.*

Year	Home consumption per hectare	Market production per hectare	Gross yeld per hectare
	fr.	fr.	fr.
1901	146.75	355.15	501.98
1910	155.15	583.30	738.45
1913	154.45	569.35	723.80
1914	178.50	662.60	841.10
1915	184.40	755.42	939.82
1916	220.72	876.31	1 097.03
1917	302.41	1 092.93	1 405.34

The data given in Table IV show that the home consumption of the products has increased considerably since 1901, but, taking the unit prices into account, this consumption has decreased in favour of production for the market.

NET REVENUE OBTAINED BY SWISS AGRICULTURE DURING THE WAR. — The net revenue of the farm represents the interest on the capital invested, whether it belongs to the cultivator or to the investor. It is calculated by deducting from the gross yield, the cost of labour, the cash expen diture, depreciation of stock, remuneration for the work, done by the farmer and his family, and all products used on, or put into, the land. In this calculation neither debts nor capital charges are entered. The notable fluctuation of the net revenue during and previous to the war indicates the need for a careful examination of the index of the projects of Swiss agriculture since 1901.

Table V gives the general averages for all the farms studied instead of averages for groups of farms classed according to size, for it is important that the general result should be kept in mind.

TABLE V. — *Net revenue obtained by Swiss farms associated with the Secretariat, in the years* 1901-1917.

Year	% interest on capital	Net Revenue per hectare of Unwooded land	Net Revenue per 100 fr. of working expenses
	fr.	fr.	fr.
1901	1.9	94.60	23.23
1905	3.3	155.60	32.70
1910	3.7	189.92	34.62
1914	3.7	200.43	38.81
1915	6.1	340.41	56.79
1916	7.9	446.49	68.63
1917	10.4	621.09	79.20
1901–05	3.07	141.15	31.39
1906–13	3.65	188.36	36.02
1914–16	5.94	329.11	54.74
1914–17	6.89	402.11	60.86

The causes which determined the increase of the unit yield also apply equally well for the net revenue. Working costs however have not risen in proportion to the gross unit yield, so that it leaves, in the last four years a continually increasing margin of profit on the invested captal. During the war the smaller increase in expenses as compared with the yields was due not only to a smaller increase in the cost price of the means of production, particularly fertilisers, forage, etc., but also to a lesser use of such means, and to a decrease in the cost of maintenance, repairs, etc.; this lesser use is obviously due to the high cost of labour and raw materials. Again, during the earlier years, whilst pre-war materials were still being used, and at pre-war cost, the extension of arable land and the high prices of the products contributed greatly to the increase in net unit revenue of the farms for those years.

In order to interpret the data accurately, it must be born in mind that most of the farms are in the hands of the peasantry, and that the owner, besides supervising the enterprise, works just the same as any member of his farm.

On the other hand the researches of the Secretariat are intended to explain facts, just as any scientific research would, and it is only occasionally that they furnish any data that could serve as a basis for valuations or estimated values which with regard to land values or the wages of the farmer and his family, could be made in different ways according to the precise aim of the valuation or attribution of value.

CAPITALISATION PER HECTARE. — In the researches of the Swiss Secretariat, the interest on Capital is taken at 4 % of the net return less

the portion set apart as working capital, called in German "Pächterkapital" "tenant capital „ which is taken as interest at 4 % on the estate. In compiling the accounting statistics of the Secretariat this value is compared with that of the inventory value as entered in the books, which derives from previous purchases, costs of production, and work in view, etc.

The inventory value is taken as the average between that of the amount of the inventory and the capitalisation value.

The capital is also increased by interest from funds.

The progressive increase of the unit value of capitalisation since 1901 is illustrated in Table VI.

The value of capitalisation is, amongst the indices of the economic result of Swiss agriculture, that which has most felt the influence of the economic system employed and the direction followed by production. This is amply proved by the flourishing state of arable cultivation during the last few years. The farms using a triennal rotation of crops, with unpastured clover fields on the Jura Mnts. derived the most benefit from fluctuations.

Grass and forage have benefited from the increased to the revenue from fruit farming, and forestry has shown a steady increase in its capital value, especially during latter years.

TABLE VI. — *Unit value of capital and inventory as shown by the Swiss Secretariat for the year* 1911-1917.

Year	Stock Value	Capital Value	Stock Value	Capital Value
	per hectare worked, working capital not included		per land value per hectare buildings, etc. not included	
	fr.	fr.	fr.	fr.
1901–1905	4 401.05	2 680.80	2 320.50	1 682.00
1906–1913	4 556.55	3 501.85	2 337.50	2 248.45
1914–1916	4 697.05	6 959.20	2 318.05	5 025.75
1916	4 704.00	9 842.85	2 335.90	7 601.05
1917	4 770.15	14 053.00	2 420.45	11 751.60

In the Alps, cattle breeding has had a very good influence on all the classes of farm, and the upper valleys have obtained similar results with the breeding and sale of cattle.

Dairy farming has contributed little to the net revenue and capital value, and has actually diminished owing to the high cost of production; only farms exclusively producing forage crops can have been especially effected. There was an improvement in the Alpine regions that produce butter and cheese, chiefly during the summer months. Table VII shows the increase in capital per hectare, in the various branches of agri-

TABLE VII. — *Percentage increase of the various factors influencing the capital value per hectare during the war years (1914-17) compared with the years 1906-13, as entered in the farm accounts controlled by the Swiss Peasants Secretariat.*

Type of Agricultural Economy	Capital in Livestock per hectare exclusive of forests	Cost of labour per hectare	Total working cost per hectare	Gross yield per hectare	Produce of Livestock per 100 fr. invested in livestock	Net revenue per hectare	Net revenue per 100 fr. capital invested in livestock	Value of the capitalisation per hectare
Triennial rotation of crop	+ 36.57%	+ 16.15%	+ 21.09%	+ 53.53%	+ 10.86%	+ 176.57%	+ 138.54%	+ 243.77%
Forage crop	+ 25.54	+ 21.54	+ 23.72	+ 48.91	+ 10.35	+ 113.48	+ 109.46	+ 142.85
Coltivation forage and arable crops.	+ 33.21	+ 22.70	+ 30.42	+ 53.33	+ 9.07	+ 114.65	+ 90.71	+ 152.35
Forage crop on the high plateaux of German Switzerland	+ 11.79	+ 18.85	+ 18.81	+ 32.66	+ 0.17	+ 68.97	+ 56.02	+ 79.95
Forage crop in the Alpine Valleys	+ 13.80	+ 19.07	+ 21.00	+ 33.96	+ 17.34	+ 67.47	+ 52.45	+ 78.28
Forage and fruit crop	+ 27.00	+ 29.59	+ 32.16	+ 57.24	+ 6.52	+ 95.95	+ 53.53	+ 105.55
Lucerne forage crops	+ 26.71	+ 29.02	+ 32.34	+ 55.25	+ 6.51	+ 104.11	+ 71.14	+ 122.35
Casual forage crops	+ 27.73	+ 31.60	+ 26.90	+ 47.57	+ 3.65	+ 85.99	+ 42.43	+ 96.67
Alpine crops	+ 88.96	+ 53.45	+ 50.47	+ 71.92	+ 9.30	+ 152.30	+ 98.84	+ 207.21
Farms of the higher valleys in the Canton of Vaud and Grison . .	+ 43.71	+ 29.34	+ 33.70	+ 69.37	+ 53.32	+ 382.64	+ 179.52	+ 1196.02
Farms on the Jura Mnts. exclusive of pasturage	+ 44.81	+ 42.41	+ 30.43	+ 71.02	+ 50.53	+ 210.27	+ 159.94	+ 421.32
Farms on the Jura Mnts, inclusive of pasturage	+ 27.68	+ 38.62	+ 12.25	+ 32.13	+ 4.78	+ 78.07	+ 117.53	+ 96.98

cultural economy comparing the increase in the averages for the years 1914-17 to those of the pre-war years 1906-13 and giving the analytical data regarding these changes.

The data given in Table VII show clearly that all the farms no matter what their system of agricultural economy or specialisation, have greatly increased the receipts. Least of all comes dairy farming which has progressed not so much owing to milk productions as to subsidiary branches of production.

THE COST OF LABOUR AND OF THE HOUSEHOLD. — The cost of manual labour includes the wages, at a fixed rate, of permanent and casual labour together with the cost to the farmer of his supervision and work as well as that of his family.

The variation in cost of manual labour before and after the war are shown in Table VIII.

TABLE VIII. — *Average cost of labour in francs per hectare.*

Year	Hectares cultivated	Employers working Expenses	Coaf of habour and food
1901	257.35	185.50	71.85
1910	328.40	224.30	104.10
1913	331.23	222'79	108.44
1915	343.62	216.10	127.52
1916	370.89	232'89	138.00
1917	470.81	300.75	170.06

For the last year (1917-18) the increased cost of labour as compared with that for 1916-17 is given in Table IX.

TABLE IX. — *Increase in labour costs in* 1917-18.

Hectares	Cost per family per hectare	%	Cost in wages per hectare	%
	fr.		fr.	
3– 5 hectares	148.70	33	14.09	18
5–10 »	86.17	27	35.03	39
10–15 »	49.24	19	25.16	27
15–30 »	34.62	23	28.76	18
over 30 »	35.25	39	27.82	18
Averages . . .	**67.86**	**29**	**32.06**	**23**

The average cost per working day, which was responsible for the increases in 1916 and 1917 is shown in Table X, and further data regarding labour costs are given in Tables XI and XII.

TABLE X. — *Average cost per working day from* 1901-1917 (*in francs*).

Year	Cost of maintenance of the employer's household	Cost of wage-earners
1901	2.96	2.17
1910	3.46	2.93
1913	3.65	2.95
1915	3.88	3.27
1916	4.15	3.60
1917	5.23	4.22

TABLE XI. — *Elements of the cost of production in* 1917.

For the employer's household :

Wage per person	Cost of maintenance	Cost of supervision
2.32 fr.	2.55 fr.	0.36 fr.

Wage earners :

Wage per person	Cost of maintenance	
1.65 fr.	2.54 fr.	—

TABLE XII. — *Increase in the cost of labour in* 1916-17.

	For the employer's household, per working day		Wage earners, per working day	
	fr.	%	fr.	%
Wage per person	0.48	39.67	0.19	24.35
Maintenance	0.67	55.37	0.59	75.65
Cost of supervision	0.06	4.96	—	—
Total increase	1.21	100.00	0.78	100.00

Economic revenue obtained from Swiss agriculture. — This revenue is the total of all the income of the persons who collaborate in agricultural production. It is interesting to note the influence of the war on this index of production which is the most important from an economic standpoint. This index on account of its importance, is given for various sizes of farms in % of the active capital, and that per hectare cultivated. Tables XIII to XVI illustrate this and the distribution of revenue per person contributing to the production.

Table XIII. — *Return on 100 fr. of working capital (in francs).*

Size of Farms	1914	1915	1916	1917	Average 1903-1905	Average 1906-1913	Average 1914-1917
3 – 5 hectares	8.20	11.31	13.00	17.41	9.20	8.94	12.48
5 – 10 »	9,53	12.36	14.47	18.69	8.57	9.78	13.76
10 – 15 »	9.46	12.10	14.69	17.86	8.50	9.24	13.53
15 – 30 »	9.36	12.43	15.20	18.45	7.92	4.50	13.86
more than 30 »	10.31	14.04	16.13	19.09	9.58	9.78	14.89
Average . . .	**9.41**	**12.34**	**14.61**	**18.35**	**87.5**	**9.49**	**13.68**

Table XIV. — *Return per hectare cultivated (in francs).*

Area	1914	1915	1916	1917	Average 1903-1905	Average 1906-1913	Average 1914-191
3 – 5 hectares	625.40	862.32	943.81	1 317.35	649.85	606,34	937.1
5 – 10 »	581.80	745.00	862.15	1 184.64	489.35	565,38	843.4
10 – 15 »	531.85	682.07	818.74	1 008.82	404.85	480,74	760.3
15 – 30 »	458.10	601.80	750.30	960.62	389.25	441,91	692.7
more than 30 »	411.95	532.04	605.64	753.35	373.40	351,13	575.7
Average . . .	**538.15**	**697.57**	**772.33**	**1 001.78**	**459.90**	**515.00**	**752.**

The labourers wages have increased from 94.33 fr. per hectare in 19(to 146.50 fr. in 1917. The return on the farmer's capital has increase on an average, from 98.60 fr. (in 1908-13) to 477.40 fr. i 1917.

Rates and taxes, which represented 11.50 % of the income betwee 1908 and 1913, have increased to 12.74 % in 1917 having reached 15.29 in 1916, the year when the war supertax was imposed.

TABLE XV. — *Distribution of the returns in % of the income, amongst the persons contributing to the production.*

Classes of farms		Number of accounts	Wages and maintenance	Employer work and supervision	Interest on loans	Return on capital invested in the farm by the farmer	Rates and taxes	Total
– 5 hect.	1915	24	2.11%	48.65%	14.35%	26.06%	1.83%	100%
	1916	30	7.90	45.62	12.67	31.86	1.95	100
	1917	35	6.80	44. 3	11.03	36.63	1.18	100
10 »	1915	104	11.25	39.75	16.59	30.34	2.09	100
	1916	125	10.14	35.65	14.40	37.85	1.96	200
	1917	151	10.26	33.04	10.93	44.88	1.29	100
15 »	1915	62	12.54	33.25	15.66	36.60	1.95	100
	1916	70	11.16	30.11	12.88	43.70	2.15	100
	1917	78	11.44	29.06	10.62	47.51	1.37	100
–30 »	1915	50	22.86	22.88	11.87	40.66	1.93	100
	1916	57	21.20	19.12	10.92	46.37	2.19	100
	1917	69	19.44	18.43	9.66	51.17	1.30	100
ore than	1915	19	27.38	16.00	19.54	36.01	1.07	100
	1916	18	29.02	14.16	17.96	41.50	1.36	100
	1917	20	29.93	13.76	11.69	50.60	1.02	100

TABLE XVI. — *Distribution of returns per hectare cultivated amongst contributing persons, in francs.*

Year	Wages and maintenance	Working expenses and cost of supervision (employer)	Interest on loans	Returns on farmers capital	Rates and taxes	Total
14	108.65	198.00	107.10	111.20	13.20	538.15
15	121.80	207.44	108.12	247.44	12.77	697.57
16	121.80	205.60	104.04	325.60	15.29	772.33
17	146.50	259.04	106.10	477.40	12.74	1 001.78
erages 1905-1917	**111.60**	**207.20**	**102.65**	**150.90**	**12.15**	**584.00**

The expenditure per hectare, for the years 1914-1917 in taxes, interest on loans, etc., and in working expenses, salaries, etc., is shown in Table XVII.

The working profit, which was $^3/_5$ of the total revenue in 1913, diminished to $^2/_5$ in 1917, whilst the capital returns increased from $^2/_5$ to $^3/_5$ during the same period.

TABLE XVII. — *Working expenses and costs per hectare* 1914-1917.

Year	Taxation, etc.	Working expenses	Total
	fr.	fr.	fr.
1914	309,20	228,95	538,15
1915	454,88	242,69	697,57
1916	531.20	241,13	772,33
1917	736.44	265,34	1 001,78
Averages 1908-1913 .	**293,72**	**208,53**	**502,25**
Averages 1905-1917 .	**357,60**	**226,40**	**584,00**

TABLE XVIII. — *The working profit and capital returns as percentages of the economic revenue (averages of all the farms).*

Year	Number of Account	Wage	Interest on Capital Rents	Taxes	Total
		%	%	%	%
1915	259	47,20	50,97	1,83	100
1916	300	42,39	55,63	1,98	100
1917	353	40,49	58,25	1,26	100
Average 1908-1913 . .	**1710**	**59,22**	**38,59**	**2,19**	**100**
Average 1905-1917 . .	**3584**	**54,59**	**43,33**	**2,08**	**100**

908 – **Agricultural Book-keeping in Canada.** *Communication from* Mr. J. K. DOHERTY *Head of the Bureau corresponding with the International Institute of Agriculture. Department of Agriculture. Ottawa.*

The following is a brief summary of the reports, sent to the Canadian Department of Agriculture, by the local authorities, on agricultural book-keeping in the Provinces.

British Columbia. — In this province farmers rarely keep accounts. The Department of Agriculture has sent out circulars to the secretaries of the Farmers' Institutes asking them to undertake propaganda on this subject among their members. So far the results have been so poor that the University authorities have decided to give courses of instruction in agricultural book-keeping.

Alberta. — The Department of Agriculture here has carried out investigations on the Demonstration Farms as to cost prices, and in order to check the results obtained, and to find out the average profits and cost the Department has kept the books of a number of farmers in the Province. The Province also provides the Agricultural Colleges with a manual giving a good simple method of book-keeping.

Saskatchewan. — The Department of Agriculture has started a book-keeping competition for crop statistics amongst its correspondents, on the understanding that all those who enter must send their books up for examination once a year.

The College of Agriculture gives courses in Agricultural book-keeping, but that is all.

Ontario. — Book-keeping in Ontario has not received much encouragement, and all that is done is to recommend its use as a necessity. The Department of Agriculture distributes gratuitously a simple method of book-keeping consisting of a register for receipts and expenses and an inventory. The problem of ascertaining cost prices has not yet been taken in hand.

The Department is now considering a thorough system of book-keeping which will be distributed shortly to the farmers, who will thus be able to collaborate in supplying data for "Farm Business Survey Work".

The State Banks have also greatly helped, during the last few years by supplying their agricultural clients with an amplified account book in which to enter cash transactions relative to farm business.

Quebec. — Two little books have been prepared, one containing a simple system, and the other a more complete one. These are sent to traders and farmers who have some knowledge of book-keeping. The local agricultural officers distribute the books to the farmers and explain how the accounts should be kept ; they examine the books at the end of the year. This method has given excellent results so far.

New Brunswick. — No definite plan has yet been adopted, but district representatives have carried out some propaganda and are distributing a book prepared by the Commission of Conservation.

Nova Scotia. — A course in agricultural book-keeping is held at the Agricultural College. No other steps have been taken.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

909 – **The Rapid Aging of Barbera Wine.** — Martinotti, F., and Garino-Canina, E. (R. Stazione enologica d'Asti), in *Giornale vinicolo*, Year XLVI, No. 25, pp. 192-194. Casale-Monferrato, June, 1920.

Although it can be said that the artificial aging of Barolo, Chianti, and Barbaresco wines is an accomplished fact, this does not apply to other types of wine. If, however, this treatment only saved 50 % of the time, it would be of decided advantage.

The authors have tried the Monti process in their experiments in aging Barbera wine. If the latter is cooled almost to freezing-point, a current of filtered air passed through it repeatedly for a given time, and subsequently exposed to a temperature of between 24 and 30° C, a deposit is formed, which is then removed. It is advisable to add 8 % of old wine.

Experiments were made as long ago as the spring of 1918, on wines coming from Montaldo Scarampi, and Montegrosso d'Asti, the classical districts of the Barbera vines. Three vintages were studied, those of 1915, 1916, and 1917.

In each case, 2 hectolitres of wine were placed in a demi-john and kept in a refrigorator at —4° C. Much time was required in order to reach the desired degree of cold. After this, the wine was aerated for 15 min. on 8 consecutive days. Glass tubes with fractionating bulbs at the end were used, and the air was filtered through plugs of cottonwool, after having first been bubbled through 95° alcohol. The refrigeration and aeration produced a thick deposit which separated by decantation. The wine was subsequently exposed for 2 months, June and July, to a temperature of 20-30° C, when a slight precipitate was again formed and removed. The wine was put in the cellar and bottled in the spring of 1919.

Three lots were made every year: No. 1, control, untreated; No 2, refrigerated, aerated, and heated wine; No. 3, the same test as No. 2, with the addition of 4 % of old Barbera wine from the same districts.

In April 1920, the wines were analysed and tasted.

No. 2 of the 1915 vintage was a bright, ruby coloured wine, and more mature by at least a year than the control, wheareas No 3, although of the same colour, and apparently at least 2 years more mature than the control, was inferior to No. 2.

No. 2 of the 1916 vintage seemed a little more mature than the control, while No. 3 was the least delicate of the three, and perceptibly aged.

No. 2 of the 1917 vintage had a finer aroma and flavour than No. 3, and its maturity was a little above the normal, approaching that of No. 3. As No. 1 had altered during the experiments, it was neglected.

It should also be noted that the 1915 wine had the old "barolo" bouquet of 12 year-old Barbera wines of this district.

In 1916, there was a great decrease in the total acidity, chiefly due to the breaking-down of the malic acid, with the formation of 2 gm. lactic acid. This applies to lot No. 3 as compared with Nos. 1 and 2.

The authors, who intend making further experiments on Barbera, Valpolicella, and Gattinara wines, give the analyses which they have already obtained in the course of their work.

910 – **The Effect of Phosphates on Alcoholic Fermentation.** — Garino-Canina, in *Le Stazioni sperimentali a·rarie italiane*, Vol. LIII, Nos. 1-3, pp. 67-78, 1 Diagr, Bibliography of 12 works. Modena, 1920.

That phosphorus is of great importance for grape ferments is shown by the fact that about 59 % of the ash of saccharomycetes consists of phosphoric anhydride. Phosphorus is important to the technique of fermentation in general, for in some rare cases, owing to the natural absence of phosphates, it may be the determining cause of the process. It plays a special part in making "filtrati dolci", and sweet sparkling wines, in which one or more substances are wanting which are necessary to the life of the saccharomycetes. Wine contains from 125-510 mgm. P_2O_5 per litre, and generally, though not always, fine wines are rich in phosphorus.

Previous investigators have already tested the effect of tricalcium phosphate, ammonium phosphate (Astruc); potassium phosphate (Meyer, Élion); to the must the author proposed to make a contribution to the study of the question by first investigating the action of phosphates upon

the saccharomycetes, and afterwards upon fermentation properly so-called.

He used a culture medium composed of: 100 gm. saccharose + 2 gm. tartaric acid + 1.5 gm potassium carbonate + 0.75 gm. potassium sulphate + 0.25 gm. magnesium sulphate + 0.10 gm. calcium chloride + 2.5 gm. asparagin + distilled water to make up 1000 gm. To this the author added increasing amounts of potassium sulphate: from a minimum molecular concentration of 0.000052 to a maximum of 0.036. When the fermentation was finished, he collected the saccaromycetes on a tarred filter, weighed them, and analysed the liquid filtrate.

The results are set forth in tables and illustrated by a diagram. On examining them critically, it can be seen that phosphorus, even when added in very small quantities, has a decided effect upon the development of the saccharomycetes. The maximum result was obtained with the molecular concentration 0.0104; this corresponds to about 1 part per 1000 of bi-potassium phosphate.

The effect was less favourable when larger amounts were used. The weight of the yeast also increased in proportion to that of the phosphorus added. In confirmation of ASTRUCS' observation, those samples to which the phosphorus had been added had a high volatile acidity.

The author made a second series of experiments upon the action of phosphates on alcoholic zymase using pure yeast that had been prepared under strictly aseptic conditions. He found that the maximum effect is obtained with 2 parts per 1000; this amount brings about fermentation after 2 minutes. The degree of fermentation was in inverse proportion to the amount of phosphate introduced.

The same experiments have been repeated with the prepared yeast "zimina" (called by the Germans "Dauerhefe"), which has the same properties as yeast-juice. The results confirmed those obtained with living yeast.

These experiments prove the extreme importance of phosphorus, even in minimum quantities, and show that experts had good reason for advising the addition of ammonium and potassium phosphates to liquids to be used for the preparation of yeast. This is especially advisable in making sparkling wines, for insufficient pressure and effervescence in these wines is sometimes due to lack of phosphates.

DISEASES OF PLANTS

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

911 – **Alteration of Grapes, in Brazil.** — PUTTEMANS, A., in *Bulletin de la Société de Pathologie végétale de France*, Vol. VII, Part 1, pp. 34-36, 1 fig. Paris, 1920.

The author draws attention to a disease attacking grapes is Brazil which he previously recorded in 1906.

It makes its appearance in some years towards the end of November, a little before the vintage, on the bunches of the « Isabelle » vine (*Vitis Labrusca*), which has long been cultivated on a large scale in the states of São Paulo and Rio de Janeiro. Vines growing as espaliers against the wall, and those in the vineyard suffer equally. On the infected bunches, which are usually the finest and most compact, berries of a livid colour are seen here and there, and these subsequently become dry and shrivel, large wrinkles appearing on their surface. Some of the grapes surrounding these berrries show the same alteration and it would seem at first sight that the disease is due to a parasite transmitted in contact from one berry to another. The malady seems to be localised in the berry for if an infected grape falls — which easily happens — the pedicel shows no sign of alteration.

A more careful examination reveals the fact that the disease is due to a want of equilibrium in growth produced by the too rapid swelling of the grapes, which is not accompanied by the simultaneous lengthening of the pedicels, or secondary ramifications of the bunch.

In fact, in the case of very compact bunches, the berries as they increase in volume tend to recede from the centre of the bunch, and exert a pull upon the pedicels which increases with the rapid swelling of the grapes. This pull, which is exerted simultaneously by several of the berries of the small secondary bunches that form the large composite bunch, ends by detaching the former from the rachis.

Very frequently, the berries in the centre of the bunch, which usually atrophy more or less, now grow in an almost normal manner, and this tends to push the berries covering them still further from the centre.

In any case, the small secondary bunches borne by the principal one, although nearly detached, still adhere by a strip of tissue, and this traumatism (change of colour and withering of the grapes) is all the more rapid when the detachment is almost complete, and atmospheric conditions are favorable.

As regards the damage done, it is not a rare thing to see a third, or even half, of the small secondary bunches thus affected and if the disease spreads to a large number of them, the yield may be considerably reduced, at any rate in certain seasons.

It seems that the phenomenon may be explained by the prevalence of special climatic conditions at the time of the ripening of the fruit. In November in Brasil, there are sometimes very rapid changes of temperature amounting to as much as 40° C and the rainfall may exceed 50 mm. in 24 hours. The abrupt change from heat to humidity may cause irregular growth such as has been mentioned above.

A certain amount of thinning early in the season, as is usually practised with hothouse grapes in order to obtain fine table-fruit, is the only remedy or palliative for this disease.

912 – **The Destruction of the Elm by Poison-Gases in War.** — GRAFFIN, R., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VI, No. 24 (June 23-30 1920), p. 609. Paris, 1920.

The elm has proved extraordinarily susceptible to the injurious effects of poison-gases, more so indeed, than any other forest tree.

In the *massif* of the Argonne chain running from the Valley of the Bar to the Meuse (Vouziers to Stenay), there are many dead elms that show no trace of having been struck by missiles, or otherwise injured.

Elms are equally susceptible whether they are growing singly or in a coppice, and their age makes no difference.

If a dead tree is found there to-day in a stand, the probabilities are that it will prove to be an elm, although this corner of Argonne was not bombarded until November, 1918, and then only for a short time, at the season when the trees had shed their leaves.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

913 – ***Bacterium atrofaciens* n. sp., Injurious to Wheat, in the United States and in Canada.** — MC CULLOCH, L., in *Journal of Agricultural Research*, Vol. XVIII, No. 10, pp. 543-552, pl. 2. Washington, D. C., Feb. 16, 1920.

DISEASES OF VARIOUS CROPS

In the course of examination of various collections of wheat of the crops in 1917 and in 1918, a new bacterial wheat disease was discovered in the United States (New York, Michigan, Kansas, Missouri, Minnesota, North Dakota, South Dakota, Oklahoma) and in Alberta, Canada.

This disease affects the leaf, ear, and grain of wheat. On the ears, the glumes show at the base a dull brownish black tinge. Sometimes, this dark area extends over nearly the whole surface of the glume ; but usually only the lower third or less is darkened, and often no discoloration is visible on the exterior. Glumes that present a normal colour on the outer surface may have the inner surface discoloured. In every case, dissection of the spikelet reveals more signs of disease on the inner surfaces than on the onter. Often a narrow dark line at the junction of the spikelet and the rachis is the only outward sign of disease. The grain enclo-

sed by diseased glumes shows varying degrees of undevelopment. The fact that the grains are often well filled out seems to indicate that the disease sometimes appears late in the course of growth. In diseased grain the base varies in colour from a scarcely noticeable brown to charcoal black. In the discoloured areas, bacteria are found in great abundance, which have been isolated and pure cultures obtained. The organism in question studied by the author from the point of view of cultural characters is considered to be the cause of the wheat disease in the pre-mentioned regions. It was a hitherto undescribed organism, and it is here designated as *Bacterium atrofaciens.*

Inoculations on young wheat plants have given rise to numerous leaf infections. Fewer mature plants have been available for inoculation of ears and besides this, weather conditions were somewhat unfavourable. However, enough infections were effected to determine the positive pathogenicity of the organism for glumes and kernels. The organism has also been re-isolated from the glumes and kernels of inoculated ears, and a second series of inoculations effected on the ears and spikelet leaves. Infection was evident also in this second case and it was possible to re-isolate the bacteria once again.

914 – **Self-Sown Wheat in Relation to the Spread of Rust, in Australia.** — WATERHOUSE, W. L., in *The Agricultural Gazette of New South Wales* Vol. XXXI, Pt. pp. 3, pp. 165-166. Sydney, May 2, 1920.

Report of periodical observations made from June 1918 to March 1919, in the Government Experiment Farms in New South Wales with a view to securing evidence on the question as to how rust of wheat survives after the heat of the Australian summer, and how the next year's crop comes to be infected.

The summer of 1918-1919 was one of the hottest on record in the districts under investigation ; drought conditions were general and no rust epidemic was reported anywhere in the State.

It should be remembered the destructive rust of the wheat crop in Australia is the black stem rust (*Puccinia graminis*). A second form, known as the brown spring rust (*P. triticina*) occurs, but it does not usually do much damage.

In June, 1918, on the leaves, stems and ears of the self-sown wheat, and in abundance on the fields reserved for this crop, a large amount of *P. graminis* in the uredo and teleuto stage was found, as well as uredospores of *P. triticina.* These uredospores were tested and proved viable. No sign of *P. graminis* was found on the cultivated crop ; although pustules of *P. triticina* were plentiful on the seedling leaves.

At the end of August, 1918, the self-sown wheat was badly attacked by rust, but on the leaves of the cultivated crops. only uredospore pustules of *P. triticina* were found. One paddock that had previously contained a self-sown wheat crop that had been attacked, and later on had been ploughed, produced many wheat plants growing up between the furrows attacked by both forms of rust ; *P. graminis* and *P. triticina.*

Towards the end of November, on the green parts of cultivated wheat, viable uredospores of both rusts were found, though practically no damage had been done to the crop. "Volunteer" wheat, particularly around haystacks, was red with *P. graminis* on all parts of the plants above ground. The field under consideration had been ploughed, reploughed and cultivated, but in spite of this, a few stray "volunteer" wheat plants carrying viable uredospores of both rusts were still to be found.

The latest inspection was made at the end of March, 1919. The summer had been exceptionally dry and very hot; no second growth had occurred, the stubble having been killed out by the dry weather in most places. A light rain in February had encouraged germination of much of the shed grain, but on these seedlings no rust was discovered. Only in one place was rusted wheat found, this was in a paddock which had laid fallow for nearly a year, ploughed a couple of months previously, and at the time of this visit was being cross-ploughed and harrowed in preparation for sowing the wheat. Here, in the centre of several much-grazed tufts of wheat that had assumed a somewhat perennial nature, were found uredo pustules on leaves, inner surface of sheaths and stems. In the cases examined the rust proved to be the brown spring rust, but it is by no means improbable that the black summer rust was also present in some of the tufts. In an adjoining paddock, no rust pustules were found on the early sown crop of wheat. Numerous pale patches were observed on many of the seedling leaves.

While these observations are far from complete, they nevertheless show the importance of self-sown wheat as an agency in the spread of rust by means of the uredospores.

915 - ***Sphacelotheca Reiliana*, New Maize Smut in Washington, U. S.** — DANA, B. F., and ZUNDEL, G. L., in *Phytopathology*, Vol. X, No. 6, pp. 328-330, figs. 4. Baltimore, M. D., June, 1920.

During the autumn of 1919, *Sphacelotheca Reiliana* (Kühn) Clinton was seen in the neighborhood of Pullman; this smut is identical with that found usually on *Sorghum* spp. but was not previously known to occur in Washington.

Two widely separated fields were attacked, one field showing 40 % of smutted plants. "Thayer's yellow dent" maize was the variety grown in both cases, the seed having been selected from local stock for a number of years.

Sori or smut masses were observed in ears and tassels only. In one field the latter were most commonly affected, and in the other the reverse was evident. In addition to this, some cases of sterility accompanied by proliferation were observed both in the ears and male inflorescence giving rise to abnormal and dwarfed development.

Occasionally a normal ear was produced on a plant showing a diseased tassel. Many plants were on the contrary seen where the ear was smutted and the tassel normal. However, in one field where a special study of symptoms was made, the ears were affected generally where smut masses were noticed on the tassels.

916 - ***Peronospora parasitica* in Turnip Roots, Indiana, U. S.** — GARDNER, M. W., in *Phytopathology*, Vol. X, No. 6, pp. 321-322, pl. 1. Baltimore, M.D., June, 1920.

Among turnip roots (*Brassica Rapa*) in storage and in the local market in Lafayette, Indiana, an occasional root was found in February, 1918, showing an internal region extending from the crown to the root with a tissue varying in colour from a light brown to a distinct black, although quite firm and turgid.

After cutting sections of one of the affected roots and placing the same in a damp chamber in the refrigerator, upon the cut surfaces of the discoloured tissue, there occurred a luxuriant development of conidiophores and conidia of *Peronospora parasitica*.

A series of inoculations were made in the conidia of the seedlings of turnip, *B. campestris* var. *Napo-Brassica* and radish. From these it was observed that the turnip seedlings were readily infected and showed abundant sporulation of *Peronospora* on the cotyledons. No infection occurred on *B. campestris* var. *Napo-Brassica*, nor on uninoculated turnips and radishes used as controls.

The occurrence of living mycelium of Perenosporaceae in turnip roots in late winter appears to indicate that it may also hibernate over the winter in turnips which remain in the field.

917 - ***Blepharospora terrestris*, a Phycomycete Parasitic on White Lupin, and New to Italy.** — PEYRONEL, B., in *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, 1st. Half-year, 1920, Vol. XXIX, Part. 5, pp. 104-107. Rome, 1920.

In December, 1919, some young plants of *Lupinus albus* suffering from rot of the roots and hypocotyl region were sent for examination to the Phytopathological Station at Rome from the estates of Pantano and Pratolongo (in the neighbourhood of Lake Regillus). All that remained of the root system was the tap-root and a few secondary roots, and there was no sign of the root-tubercles. The entire surface of both the roots and the lower part of the stem was of a dark-brown colour and soft to the touch ; all the leaves, except a few at the top of the stem, were withered.

The author found by microscopic examination of the affected parts that the roots and nearly the whole hypocotyl were infected and completely disintegrated by a mycelium which, from its morphological characters, appeared to be that of a phycomycete. In the cortical tissue of some quite young plants, he discovered the oospores of the fungus.

With the object of increasing the material for study, and of observing the behaviour of the fungus, the author prepared two series of lupin cultures in cylindrical pots without any drainage hole. As soon as the plants put out their first leaves, he watered them in such a way that the soil was always covered with a layer of water 1-2 cm. deep. One series of the seedlings he kept for a control ; amongst the others, he planted some infected lupin plants (that had been kept in water). The result of the experiment was that the seedlings growing with the infected plants all died, while the control seedlings remained perfectly healthy.

In the root tissues of the dead plants, the author found only mycelium, but in the cortical tissues, there was a large number of oogonia and ripe oospores, the latter being identical with those present in the material forwarded for examination.

On the submerged cotyledons of the dead seedlings, he subsequently discovered a thick external mycelium floating on the water, and as microscopic investigation revealed, bearing large zoosporangia.

The observations hitherto made, allow of the identification of the fungus in question as *Phytophthora terrestria* Sherbakoff, found in Florida.

Before the author had discovered its identity with *Ph. terrestria* he had been struck by the extraordinary similarity between the fungus he was studying and *Blepharospora cambivora* Petri, now believed, as is well-known, to be the specific agent of the " Ink Disease " of Chestnuts. It is evident, according to the author, that the species described by Sherbakoff has all the characters of the genus *Blepharospora* as defined by Petri, although it is very distinct from *Bleph. cambivora*. The author proposes the name of *Bleph. terrestris* (Sherb.) Peyr. for the fungus examined by him.

M. Peyronel is induced to believe that the fungus in question is not a recent importation from America, but a ubiquitous species already existing in Europe, and usually living as a saprophyte in very damp soils, but capable, under favourable conditions, of adopting a parasitic mode of life.

No control measures can at present be suggested beyond the destruction of infected plants, and the disinfection of the soil with carbon bisulphide or formalin. It is also advisable to grow a herbaceous plant, for some such as a years cereal, that is immune to the disease, instead of lupins.

918 - ***Ustilago Coicis* on *Coix Lachryma-Jobi* in the U. S.** — Thomas, C. C., in *Phytopathology*, Vol. X, No. 6, pp. 331-332, figs. 1. Baltimore, M. D., June, 1920.

On a speciman of *Coix Lachryma-Jobi*, grown in the Plant Quarantine Greenhouse of the United States Department of Agriculture obtained from seed coming from Kalasungay, Mindanas (Philippine Islands), was noticed towards the end of December, 1919, the appearance of " Coix smut" (*Ustilago Coicis* Bref.), a disease not hitherto reported in North America.

Every grain affected is converted into a black spore mass, slightly increased in size, which, however, in some cases may reach to almost double the size of a normal grain. The grain may be badly deformed or it may be almost normal in outward appearance. The spore mass is surrounded by a membrane and is more or less hidden by glumes. The leaves and portions of the culms adjoining the diseased grains are distorted and bent.

The life history of the parasite is unknown and it is difficult to say in this case whether it was introduced by spores on the seeds or by dormant mycelium within.

919 - ***Polyporus igniarius* Injurious to the Vine, in Tunisia.** — Kien, E., in *Revue de Viticulture*, Year 27, Vol. LII, No. 1347, pp. 289-290. Paris, 1920.

Numerous cases of the death or partial withering of vines at the pruning season were observed in the neighbourhood of Tunis in 1919, and still

more frequently in 1920. The varieties chiefly affected were " Carignan " and " Alicante ".

The author's investigations have shown that the diseased vines were always infested by a mycelium which is probably that of *Polyporus igniarius*, and the author recommends the disinfection of the pruning-knife by passing it through a flame, before going from one vine to another.

920 - ***Monilia fructigena* and *M. cinerea*, Brown Rot Diseases of Fruit Trees (*Pyrus* and *Prunus* spp.) in Great Britain.** — WORMALD, H., in *Annals of Botany*, Vol. XXXIV, No. 134, pp. 143-171, pl. 2, bibliogr. of 30 works. London, April, 1920.

In Great Britain there are two species of *Monilia* parasitic on fruit trees of the genera *Pyrus* and *Prunus*, namely, *M. fructigena* Pers., (=*Sclerotinia fructigena* [Pers.] Schröt.), and *M. cinerea* Bon.

The two species are to be distinguished by the colour and size of the pustules, by the dimensions of the conidia, by the mode of growth on sterilised culture media, by the mode of branching of the germ tube of conidium, and by the mode of parasitism.

M. fructigena causes a fruit rot of apples, plums, and cherries and on apple trees may produce cankers by invading the branch through the fruit.

M. cinerea occurs also on apple, plum and cherry trees and causes disease as follows: — apple trees: blossom wilt and canker disease; — plum trees: fruit rot, blossom wilt, canker, and wither tip of young shoots; — cherry trees: fruit rot, blossom wilt, and may kill twigs by penetrating through the flowers.

In *M. fructigena*, conidia production is inhibited during winter; *M. cinerea* on the other hand begins to develop new pustules about the beginning of December and produces conidia freely during winter and spring.

The winter conidia of *M. cinerea* are considerably smaller than those produced in the summer.

The form of *M. cinerea* parasitic on apple trees is biologically and physiologically different from the form found on plum and cherry trees. *M. cinerea* f. *Mali* produces an apple blossom wilt; it readily secretes an enzyme which oxidises tannins; *M. cinerea* f. *Pruni*, when plum blossoms are inoculated with conidia, this attacks only the flowers actually inoculated and does not attack the axis of the inflorescence; it secretes the oxidising enzyme far less freely than the apple.

The oxidising ensyme is secreted freely by *M. cinerea* f. *Mali* when growing in a liquid culture media, on diseased apples, and on diseased apple spurs.

The American form of *Monilia* is more nearly related to *M. cinerea* than to *M. fructigena*, but in cultures it can be distinguished from the European form of *M. cinerea* by its mode of growth and by the numerous fructifications produced on all the culture media on which it has been grown up to the present time.

921 - ***Pucciniopsis Caricae*. Leaf Blight of the Papaya (*Carica Papaya*), in Florida.** — STEVENS, H. E., in *The Quarterly Bulletin of the State Plant Board of Florida*, Vol. IV, No. 3, pp. 98-100, Gainesville, Flo. April, 1920.

A leaf blight of the papaya (*Carica Papaya* Linn., has recently been reported at St. Cloud (Florida), where it was learned from the owner of the plants attacked that the disease first made its appearance in 1920 and spread very rapidly. The disease was also observed on some of the plants in a neighbouring farm.

This is not a new disease and has been previously reported in Porto Rico, Cuba, British Guiana and Sanibel Island, Fla. This appears, however to be the first record of its presence on the mainland of Florida, and it might prove to be a serious pest to the papaya in the southern part of the State should the disease become widely distributed.

The disease, which is caused by *Pucciniopsis Caricae* Earle, is easily recognisable by the round black, pustular spots on the under surface of the leaf which enclose the septate spores of the fungus. On the upper surface, the infected areas appear as small brown circular spots, distinctly outlined. From a few to several hundred spots are likely to be present on a single infected leaf.

Severe attacks will engender defoliation of the plants resulting in death or a very much weakened plant.

If the disease is discovered in time, it can probably be easily controlled by the use of Bordeaux mixture. Three or four sprayings at intervals of 10 days to 2 weeks apart on both sides of the leaves should be sufficient to put down a mild attack. In cases of severe attacks, all of the older infected leaves should be removed and destroyed. The remaining foliage should be thoroughly sprayed with Bordeaux mixture at weekly intervals, until the new leaves that develop are entirely free from infection. If the badly infected plant is a young one, it will be more economical to destroy the same and re-commence with another healthy plant. All the seedlings should be closely watched, especially if they are grown in the vicinity of old diseased plants. In such cases frequent application of Bordeaux mixture will be necessary to protect then from disease.

When the disease appears, efforts should be made to eradicate it as quickly as possible.

922 - **On the Presence of Oak Oidium in Brazil.** — PUTTEMANS, A., in *Bulletin de la Société de Pathologie végétale de France*, Vol. VII, Part I, pp. 37-40. Paris, 1920.

In a garden of the town of São Paulo, the writer first observed oidium on October 1, 1912, on trees of *Quercus pedunculata* of about 15 years of age. The fungus was heavily parasitised by *Cicinnobolus Cesatii*.

A very large number of oaks growing in different public and private gardens were inspected the next day, and only in rare cases were they found to be attacked ; a week later, however, oidium was distinctly visible on most of these trees.

Shortly afterwards, M. MAUBLANC informed the author that he had found the same fungus at Campinas (about 100 km. from São Paulo) ; in April 1913, the author himself saw it at Petropolis and Nova Friburgo

(State of Rio Janeiro) on specimens of *Q. palustris* Du Roi amongst others ; about the same date, M. MAUBLANC met with it also in Argentina.

It should be mentioned that, at São Paulo during the second half of 1912, a damp period hot and very rainy succeeded one of abnormal cold ; this state of affairs was very favourable to the development of the fungus, which under such conditions, causes serious injury, even to large trees.

The sudden appearance of oidium in Brazil, five or six years after it had been so common in Europe, is no doubt a proof that it was introduced from that continent.

As for the mode of its introduction, the author does not think it likely that the perithecia of the fungus were transported (1), for these organs have always been extremely rare everywhere ; he also thinks that it is impossible that the disease should have been introduced into Brazil by young imported oaks, seeing that the oak is so easily propagated by the acorns which the trees of the country produce in abundance.

Leaving out of account the transport of living ocean or windborne conidia, which however might occur, there only remains to consider whether, the common, conidial form of the fungus might not have been carried by some fast ship. Experiments made regarding the duration of the germinative power of oidium conidia, as compared with the time necessary (8-9 days) for their transport to Brazil (port of Rio de Janeiro) from the nearest infected region (Madeira, where oidium was reported in 1908), have led the author to believe that as the germinative power of the conidia has been known to last ten days, this form of the parasite could well have been carried by a trans-Atlantic liner, and this might have occurred very many times during the four years between the discovery of the disease in Madeira, and its appearance in Brazil.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

MEANS OF PREVENTION AND CONTROL

923 – ***Coccinella sanguinea*, a Beetle Preying on Aphids in Cuba.** — SUAREZ, C., in *Revista de Agricultura, Comercio y Trabajo*, Year III, Vol. III, No. 2, p. 75. Havana, 1920.

Coccinella sanguinea, popularly known as " cotorrita roja ", is a very common beetle throughout the island of Cuba.

The author had the opportunity of observing the larvae feeding on the aphids that attack various cultivated plants: — *Gossypium* sp., *Meibomia leiocarpa*, *Hibiscus Sabdariffa*, *Citrus* sp., etc. He found that the insect reproduces itself throughout the year, but chiefly during periods of drought when aphids are especially plentiful The author gives a short morpho-biological description of the beetle from the egg to the adult stage.

(1) *R.*, February, 1920, No. 264. (*Ed.*)

924 - ***Coracias indica*, Beneficial Bird to Agriculture,, in India.** — FLETCHER, T. B. and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XV, Pt. I, pp. 1-4,, 1 col. pl. Calcutta, Jan. 1920.

The Indian Roller or Blue Jay (*Coracias indica*), occurs in considerable numbers throughout the Plains of India and Ceylon, and is easily recognised when on the wing owing to the brilliant colour of its feathers.

The breeding season takes place in Bihar from March to the end of June, and in January in Ceylon. The nest is made in a the holes of a tree or building, and four or sometimes five eggs are laid.

Besides being an ornament to the landscape, *C. indica* is an extremely useful bird, as its food consists almost entirely of large insects, such as grasshoppers (*Acridae*), crickets (*Gryllidae*), and beetles (*Coleoptera*), and occasionally small mice, frog snakes, or even toads.

An examination by C. W. MASON of the stomachs of 18 birds between January and October at Pusa, led to the discovery of 412 insects eaten by these birds; 4 only were beneficial, 111 injurious, and 297 neutral. Of the injurious insects captured by *C. indica*, 52 were grasshoppers, 18 crickets, 22 caterpillars, mostly cutworms (*Noctuidae*), so that the benefit obtained by the destruction of these injurious insects far more than counterbalances the fact that very few beneficial insects were taken.

The bird is protected under the Wild Birds and Animals Protection Act, throughout the whole year in Bihar, Orissa and in Delhi. In spite of this, Europeans frequently shoot them especially in the neighbourhood of military cantonments, for the sake of the brilliantly coloured wings.

925 - ***Prodenia litura* and *Cirphis loreyi*, Caterpillars Injurious to Crops of Northern Gujarat, India.** — JHAVERI, T. N., in *The Agricultural Journal of India*' Vol. XV, Pt. 2, pp. 181-184. Calcutta, March, 1920.

In the early part of the monsoon of 1919 after the long and almost unprecedented drought which had resulted in the famine of 1918-19, the farmers were alarmed to find their crops of maize, *Pennisetum typhoideum*, *Paspalum scrobiculatum*, and also chillies and rice etc., attacked by swarms of small dark brown caterpillars which appeared likely to do very serious damage.

These caterpillars, identified as *Prodenia litura* and *Cirphis loreyi* — recognised as well known pests capable of serious damage in many parts of the tropical world — seemed in this case to be confined to the parts of Gujarat where a light soil occurs. They were observed in Surat, Kaira, and in the Panch Mahals and in Barodo, where although known previously, had never been found in such abundant quantities.

The first sign of attack was usually a partial destruction of the leaves; sometimes on an examination of the latter, a group of caterpillars was traced. In the case of cereals, they were often found in the funnel composed of the leaf-sheaths round the central shoot of the plant.

The reason for the exceptional attack in 1919 can probably be attributed to the absence of rain for a very long period.

The caterpillars pupate in the ground chiefly in the higher land, at a depth of 2-3 in. Under conditions of normal moisture, it remains in

his state from 1 to 6 weeks, but with the exceptional drought in 1919, it is quite possible that the pupae may have remained much longer in their concoons. At any rate, the first rains of the second week in June were followed by a remarkably large emergence of moths which laid eggs on many plants, but particularly on the early sown crops and on the grasses which were just springing up. As each female moth laid about 500 eggs in several small masses along a leaf, and as these eggs hatch in about 4 days, it will be easily understood that by the end of June, the small caterpillars were spreading over all the suitable crops growing at the time. As the caterpillars developed, they were found feeding in the early morning, evening and night. During the hot part of the day, they were concealed in the soil or at the base of the leaves of the plant attacked.

The majority of caterpillars which had made their appearance at the end of June, disappeared in the third week of July ; those which had become fully developed retired to pupate in the soil ; others were badly attacked by tachnid flies. These latter parasites were found as small maggots on the viscera of the caterpillars, while their eggs were noticed on the surface. At this time, too, there was a good deal of heavy rain, and on examination of the soil of the higher lands, the majority of pupae were found to be in state of decomposition, probably as a result of the wet conditions in which they found themselves. Partly, therefore, as a result of the parasites, and partly on account of the rains, the much dreaded second brood, which should have appeared early in August, never gave rise to the alarm which had hitherto prevailed.

The observations made in connection with the attack in 1919 have brought to the fore a number of preventive measures which will if widely practised, lead to successful results in the future. In the first place, the land should be ploughed up before the advent of the rains, or still better, as soon as the previous crop is harvested. By this means, the pupae in the ground will be turned up and either dried out by exposure to the sun or devoured by insectivorious boids. The moths, at least of *C. loreyi* are moreover easily attracted to light, and if a numbrer of lamps are placed in the fields, each standing in a tray of kerosine and water, or if some fires made of brushwood are lighted for a few days after the first rains and the corresponding emergence of the moths, a very large number will be destroyed before they have had a chance to lay eggs.

Also it is equally advisable to delay for a few days the sowing of the the crops. It is a frequent practice to sow immediately after the first rains. This was done in 1919. and the crops so treated were those most attacked. Crops sown a fortnight later were, on the contrary hardly, attacked at all. In special cases, in addition to the precautions enumerated above, children may be employed to collect and burn the leaves on which the egg masses are found and on which also the swarms of very young caterpillars are feeding. In the case of seed beds or fields containing valuable crops, a trench should be dug round the seed bed or field in which green plants can be put in the evening. The large caterpillars sheltering in it can be destroyed the following morning.

926 – ***Trachelus tabidus*, Black Grain-Stem Sawfly of Europe, Injurious to Wheat and Other Cereals, Introduced into the United States.** — GAHAN A. B., in *United States Department of Agriculture, Bulletin* 834, pp. 1-18, fig. 1, pl. 2, bibliogr. of 56 works. Washington D. C., May 10, 1920.

During the summer of 1918 it was discovered that another exotic insect liable to cause considerable damage to agriculture, has become established in America. A complaint was received by the Bureau of Entomology, Washington, D C., from a correspondent at Gaithersburg (Maryland) regarding the work of certain attacks which had caused serious damage to ripening wheat, and steps were immediately taken to investigate the outbreak with the result that this insect was identifield as *Trachelus tabidus* (Fabricius) Jurine ; this sawfly belonging to the genus *Cephidae* has already been referred to in European literature (England), and goes by the popular name of " black grain stem sawfly ".

In the Old World Continents, the species occurs throughout most of central and southern Europe, south-eastern Asia, ad northern Africa.

In America, the insect was found, before 1918, in New Jersey, Virgiania, Delaware, Maryland, Pennsylvania and New York.

It is probable that the species has even now spread and is likely to spread over a very wide area of the New Continent just as it did the Old.

Various cereals, especially wheat, but also barley and rye, have been attacked, and the Russian records are more specific and confirm this statement.

In America only wheat and rye have thus far been recorded ; it appears certain that wheat is the food plant preferred. It is not improbable that *Tr. tabidus* also attacks plants other than those mentioned.

The author gives the synonymy of the insect, and describes the adult and the hibernating larva, and also makes preliminary observations with reference to the life history of the sawfly.

The larvae burrow downwards through the stem pith hollowing it out to the base ; before preparing to hibernate, this larva severs the stem from the inside at or very near the surface of the ground, leaving the epidermis of the straw intact sufficient to allow it to stand erect ; the first slight bending of the ripened straw causes it to snap off and fall, having the same effect as a strong wind.

An efficacious chalcidoid parasite of *Tr. tabidus* has been notified in America ; reared from a species which has apparently never been described, belonging to the genus *Pleurotropis*.

It is recommended to plough in the stubble containing the larvae so deeply that the maturing adult will be unable to escape. Wheat, barley and rye should be followed by some crop which will not serve as a host plant, such as maize or market crops.

927 – ***Cephus cinctus*. Hymenopteron Injurious to Wheat, Rye and other Cereals in the United States.** — AINSLIE C. N., in *United States Department of Agriculture, Bulletin* 841, pp. 1-27, figs. 16, Washington. D. C., May 7, 1920.

The Western Grass-stem Sawfly (*Cephus cinctus* Norton), an indigenous species of the (United States is becoming a serious menace to the grain crops in the Northwestern States.

It appear that various species of *Elymus* and *Agropyron* have been the original host plants of the larvae. Since their feeding habits have been modified by changing agricultural conditions, to the host plants already mentioned may be added the following : *Hordeum jubatum, Bromus inermis, Phleum pratense, Deschampsia* sp., *Calamagrostis* spp., *Festuca* sp., wheat, durum, spelt, rye and probably barley. On wild *Gramineae* and on wheat, the insect has also been observed in North-west Canada.

The egg is always laid in the stem of the host plant either in the hollow of the stem, or in a split made by the saw of the insect. The larva when it escapes from the egg begins almost at once to feed upon the parenchymatous tissue by which it is surrounded in the interior of the stem, excavating for itself a gallery both above and below the spot where the egg formerly lay. When mature the larva makes for the extreme base of the stem, where it does not delay in beginning its preparations for hibernation. Usually at or slightly above ground level, it cuts round and inside the stem, but never severs the stem completely, although this is so weakened that the upper part of the stem above the cut, bent over by the wind, breaks off altogether when dry. After cutting its characteristic groove within the stem, the larva continues to remain there and forces a mass of debris into the bore just below the groove and in this manner plugs the upper end of the stubble that is to be left in the ground after the upper stalk has been broken away. In this way, the larva moves freely until the time of pupation arrives the following summer.

Under normal conditions, when *C. cinctus* lived exclusively in grass stems, the larvae were attacked with varying degrees of success by two or more species of parasites which apparently had not followed the sawfly during its course on the wheat and on other coltivated grasses. The most common parasite is the chalcid *Pleurotropis utahensis*, Cwfd. ; the braconid *Microbacon cephi* Gahan also attacks the larvae in grass stems.

The most effective artificial means of control that can be suggested. at present is perhaps deep ploughing and burying at least 5 to 6 in., deep the stubble attacked by the larvae, to hinder the adults emerging. The ground should in addition to this be adequately rolled.

In certain parts of the United States, the occurence of *C. cinctus* appears to have been confused with that of its congener *C. pygmaeus* L., a stem borer injurious to wheat and probably imported from Europe only a few years previous to the first mention of *C. cinctus* in the United States. The habits of the two species are very similar. As for as it is now known *C. pygmaeus* is not found west of the Mississipi ; while *C. cinctus* has oft, en been found west of this river.

928 – ***Schoenobius incertellus, Chilo suppressalis,*** and ***Cnaphalocrocis medinalis,*** Microlepidoptera Injurious to Rice in Indo-China. — VINCENS, F., in *Bulletin agricole de l'Institut scientifique de Saïgon*, Year II, No. 4, pp. 97-105, 2 plates. Saïgon, April, 1920.

The author describes the lepidoptera most commonly found in the Cochin-China rice-fields, which are especially frequented by *Schoenobius*

incertellus Wlk, *Chilo suppressalis* Wlk, and *Cnaphalocrocis medinalis* Guénée (fam. *Pyralidae*).

Of the three, *Sch. incertellus* and *Ch. suppressalis* alone do appreciable injury to rice. Both of them, when in the caterpillar stage, destroy the green shoots, causing abortion in many panicles, but whereas *Sch. incertellus* attacks the whole rice-field, *Ch. suppressalis* concentrates its efforts on circular patches which increase little in size. *Sch. incertellus* over-winters at the base of the stubble left standing after the harvest, and *Ch. suppressalis* lives and reproduces itself on the wild herbaceous plants growing in the rice-field after the crop has been harvested.

To lessen the damage wrought by these two insects, the author advises the following measures:

(*a*) The cutting-down and burning of the weeds that have sprung up in the rice-field and the surrounding fields. This should be done before sowing and planting out.

(*b*) The lighting at intervals (during the vegetative period of the rice) of large fires of brushwood on moonless nights, when the presence of the adult forms of *Sch. incertellus* has been observed in the rice-field. The uprooting and burning of all infected rice-plants forming large yellow patches in the field should be carried out.

(*c*) After the harvest, the straw remaining in the field should be burnt and the soil lightly hoed, in order to break up and aerate the surface soil, and uncover the lower parts of the stubble that the fire has not reached.

Although *Ch. medinalis* is more frequently met with than the other two insects in Cochin-China rice-fields, fortunately it does but little harm, owing probably to the attacks of its numerous parasites. The caterpillars attack the laminae of the rice leaves making longitudinal furrows throughout their length ; along these they devour the green tissues only sparing the lower epidermis. The leaves thus look as if they were striped longitudinally ; later, they are badly torn parallel to the vein, which tends to rupture the delicate, exposed epidermis. It is clear that leaves thus deprived of much of their chlorophyll tissue make less starch, and that the culms bearing them will produce panicles consisting of grains with a lower starch content, but it would be necessary for the insects to be unusually plentiful for them to cause any loss that is really appreciable at the harvest.

Hence, the losses caused by *Cn. medinalis* are too limited for it to be worth while controlling this insect. As however, the adults are attracted by light, a certain number are always destroyed by the fires lighted to kill the adult forms of *Sch. incertellus*.

929 - ***Nezara viridula*. The Southern Green Stink Bug, Injurious to Cultivated Plants in Florida** (1). — DRAKE, C. J., in *The Quarterly Bulletin of the State Plant Board of Florida*, Vol. IV, No. 3, pp. 41-94, figs. 33, Gainesville, Fla, April, 1920.

It often happens that *Nezara viridula*, L., becomes a serious pest to cultivated plants in Florida. Its depredations are also well known

(1) See also *R.*, Feb., 1913, No. 194 ; *R.*, May, 1913, No. 609 ; *R.*, Mar., 1917, No. 298 ; *R.* Aug. 1918, No. 927. (*Ed.*)

in other southern States, but particularly in the Gulf States. The insect is of foreign origin and is almost universally distributed throughout the tropical and sub-tropical regions of the entire world. Its ravages have also been reported in Australia, India, West Indies, Austria and other countries.

Both nymphs and adults of *N. viridula* obtain food by puncturing the tissues of plants and then extracting plant juices. All parts of the plant are attacked, but tender young shoots and maturing fruit are much preferred.

Amongst the numerous plants attacked are tomato potato, sweet potato, beans, *Vigna sinensis*, *Raphanus* sp., *Brassica* spp., *Hibiscus esculentus*, etc. In autumn and early winter, the insect sometimes becomes a serious pest in citrus groves, feeding especially upon the fruit, young seedlings and young shoots of older trees. Similar infestations have been reported for pecan groves (*Carya Pecan*).

From observations made at Gainesville, Florida, it was ascertained that hibernation is imperfect, and about one-half of the individuals remain upon plants in the field throughout the winter months ; no breeding takes place during this period. Eggs have been found out of doors the second week of April and as late as December 12. The eggs are deposited in clusters, mostly on the under surface of the leaves. Some females deposited no eggs, while others laid one, two or, even three egg clusters. One single female laid 212 eggs, three clusters of 78, 70 and 64 eggs respectively. No eggs were found in her ovaries at death. In the field, 40 egg clusters collected consecutively, contained an average of a little ove r88 eggs per cluster. Each cluster consisted of from 46 to 126 eggs.

The minimum period for incubation was 4 days. The minimum time for the 5 nymphal stages was 24 days, which points to the conclusion that only 28 days is required from the time the eggs are laid until the adult stage is reached. Field records indicate that there are 4 generations annually at Gainesville and probably 5 in the southern portion of Florida. Development was more rapid during the summer than in either spring or autumn, the temperature having an important bearing upon the period of development of both eggs and nymphs.

Six predaceous enemies have been recorded in the field, the bug, *Euthyrhynchus floridanus* being the most important. Three parasites of the adult and 2 egg parasites have been reared. Out of 800 adults of *N. viridula*, collected in the field during the latter part of May and the beginning of June, 38 % were killed by two dipterous parasites, 31 % by the tachinid fly, *Trichopoda pennipes*, and the rest by *Sarcophaga sternodontis*. The egg parasites were not common at Gainesville ; and are represented by species as yet undescribed.

In most cases, parasitised specimens of *N. viridula* failed to deposit eggs before they died. Breeding experiments conducted in the insectary show that, if the eggs are nearly or fully developed within the ovaries of *N. viridula* when the eggs of *Tr. pennipes* are deposited on her body, a female will sometimes deposit eggs after being parasitised. In this

case, not more than one egg cluster is laid before the insect is destroyed. Pairs have been collected while feeding and copulating in the field during the late afternoon, and both sexes died from the effects of parasitism the ensueing night.

When important crops are infested, hand collecting seems to be the best control method. The cutting of the cover or soiling crop will usually keep the insects under control in citrus groves, also in pecan groves.

In cases of severe attacks in citrus groves, it has been demonstrated that hand collecting with large nets can be done successfully and profitably. In using such nets, the work should be done in the early morning or on cool days, when the temperature is below 70° F. At a higher temperature, many of the adult bugs will save themselves by taking flight before they drop into the nets.

Amongst the wild and cultivated plants, the insects generally show a decided preference for leguminous and cruciferous plants. During the autumn, winter (individuals that do not seek protection to hibernate) and early spring, the bugs often congregate upon crucifers such as *Raphanus* spp., *Brassica oleracea* var. *acephala*, *B. chinensis*, *B. Napus*, *B. Rapa*, etc. Some of these plants might serve as a valuable trap crop during these seasons. Experiments at Gainesville, during the summer, show that *Raphanus* and *B. oleracea* var. *acephala*, both growing in the same row, will serve as a trap crop to protect tomatoes.

The seed should be sown about November 1, so that *Raphanus* will be forming pods while the fruit of the tomato is developing and ripening. The insects should be collected by hand.

Leguminous plants (*Vigna sinensis*, *Crotalaria usaramoensis*, haricots, etc.) are much preferred to other plants in the summer and early autumn, especially during the pod formation period. Probably *C. usaramoensis* offers one of the greatest possibilities as a trap and propagating centre for the natural enemies of the bug, during the summer. The plant itself is probably not more or perhaps as attractive to the bugs as *V. sinensis* but the blossoms are very alluring to the *Nezara* parasites. The principal parasite, *Tr. pennipes* ti evidently a constant visitor to the flowers of *C. usaramoensis*. From 10 to 80 % of the specimens of *Nezara* collected on *C. usaramoensis* bore eggs of *Tr. pennipes*. For this reason, it seems evident that this plant should be grown during summer and thus increase the number of parasites. The long blooming and pod-formation period adds much to the value of this leguminous plant as a trap and propagating centre for the natural enemies of *N. viridula*.

930 – **Some Lepidopterous Pests of Sugar Cane in Queensland.** — JARVIS E., in *Queensland Bureau of Sugar Experiment Stations, Division of Entomology, Bulletin* No. 9, pp. 5-16. pl. 1. Brisbane, 1920.

The author records the presence in North Queensland of a few Lepidoptera notified as injurious in the larval stage, to the leaves of the sugar cane. These include :

1) *Cirphis loreyi* Dup. ; 2) *Mocis frugalis* F. ; 3) *Melanitis leda* L. ; 4) *Padraona hypomoloma* Lower ; 5) Undetermined species of Fam. *Psy-*

chidae near gen. *Hyalarcta* ; (6) *Anthela acuta* Walker ;(7) *Ophiusa melicerte* Drury.

The author gives a concise description of these insects in conjunction with biological data ; he also mentions advisable methods of control of certain species.

931 – ***Maculolachnus rosae*, an Aphis Injurious to Rose-Bushes in France.** — GAUMONT, L., in *Bulletin de la Société entomologique de France*, 1920, No. 2, pp. 26-31, Figs. 4.Paris, 1920.

Cultivated and wild rose-bushes are not only attacked by the common and very destructive aphis, *Macrosiphum* (*Siphonophora*) *rosae* L., but also by another which, according to the author, has as yet been little studied.

This insect belongs to the group *Lachnina*, described under the mame of *Lachnus rosae* by CHOLODKOWSKY as a parasite of rose-bush roots in Thuringia.

The author foud this aphis in 1915 and 1918 on wild roses near Wesserling (Upper Alsace), and was able to follow its entire life-cvele, which he describes in the present article. It is often found on cultivated roses in the centre of France : round Montargis. M. MARCHAL observed it in 1910, at Fontenay-aux-Roses (Seine).

The injury caused by this insect is quite as serious, though not as apparent, as that done by *Macrosiphum* (*Siphonophora*) *rosae*, Sprays containing nicotine are very useful in the control of these pests.

On account of the systematic characters of this aphis, the author considers it is necessary to establish a new genus for it. It will therefore be known as *Maculolachnus rosae* (Cholodk).

932 – ***Aspidiotus uvae*, Grape Scale in California.** — ESSIG, E. O., in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. IX, Nos. 1-2, pp. 37-39, figs. 2.Sacramento, California, Jan.-Feb., 1920.

There appears to be no published record of the occurence of grape scale (*Aspidiotus uvae* Comst), in California. Specimens were collected from the American vine of the Catawba variety at Oakland, November 7, 1919. The scales of this pest were abundant upon the old canes as well as on the one year old wood, and were usually hidden under the bark of the host plant.

Various other scale insects have been notified as attacking grapes in California, namely : *A. hederae* Vall., *A. camelliae* Sign., *A. perniciosus* Comst., *Icerya purchasi* Mask., *Pseudococcus bakeri* Essig, *Ps. citri* Risso, *Ps. longispinus* Targ., *Pulvinaria vitis* L., *Coccus hesperidum* L., *Lecanium corni* Bouché, *L. persicae* Fabr., *L. pruinosum* Coq., *Saissetia oleae* Bern., *Chrysomphalus aurantii* Mask., *Lepidosaphes ulmi* L.

Although the scale insects found attacking the grape appear to be numerous, practically none of them are of any importance in commercial viticulture, but some are at times very troublesome in small household vineyards.

933 - ***Anomala undulata*, Injurious Beetle on the Mango (*Mangifera indica*), in Florida.** — MOZNETTE, G. F., in *The Quarterly Bulletin of State Plant Board of Florida*, Vol. IV, No. 3., pp. 95-98, figs. 1. Gainesville, Fla., April, 1920.

When the mango is in bloom it may be visited by swarms of the beetle *Anomala undulata* Mels. which when present in considerable numbers may cause serious damage to the plant. Up till now, this species has attracted attention of growers in the Dade County south of Miami (Florida).

The insect was first brought to the authors' notice in February, 1919, when a grower at Larkins, Florida, reported the serious damage caused by *Mangifera indica* to his own mango blossoms. Upon examination, the author discovered that the flowers were severely attacked, the insect having damaged all portions of the blossom in many cases completely encircling the same or cutting it entirely off. Usually, however, the beetles confined their attacks to the floral clusters about the spikes. The beetles were often seen to congregate at the base of the floral spikes where they gnawed away the outer tissues, in some cases, gathering at the tops of the spikes, destroying everything that came into their path.

During the day, the adult beetles were to be found in a quiescent stage in holes in the soil from whence they passed in the early morning up the trees, feeding on the blossoms.

To give an idea of the abundance of these beetles observed feeding on the mango, the author states that at Larkins, under a tree that had been shaken only once, approximately 1300 adult beetles were collected.

The larvae feed probably on the roots of some native or cultivated plant. Up to the present, the author has been unable to find either the larval form or the host plant.

The author has also noticed this species feeding on avocado blossom (*Persea gratissima*). The species had also been found distinctly injurious to beans at Redlands (Florida), and engendered defoliation. In addition to this, the same beetle has been recorded as infesting a variety plants of both herbaceous and woody.

The best means of control as regards the mango, consists in spraying the blossom spikes with either powdered arsenite of zinc or arsenate of lead diluted with: Bordeaux mixture and sufficient soap to assist in the wider diffusion of the combination spray.

934 - ***Ehrhornia cupressi*, Coccidae Injurious to *Cupressus macrocarpa* in California.** — HERBERT, F. B., in *United States Department of Agriculture, Bulletin* 838, pp. 1-22, figs. 5, pl. 6. Washington, D. C., June 5, 1920.

Cupressus macrocarpa is one of the most popular shade and ornamental trees in California It is planted separately or in hedgerows and often trimmed into set shapes; due to its well developed and thick habits it makes a good wind-break in exposed areas. It is used expecially along the coast and in the sandy citrus areas of San Bernardino County. It is also cultivated as an ornamental tree in many other parts of the world,

The cypress bark scale, *Ehrhornia cupressi* attacks a large number of trees in California, causing serious damage, particularly to the thickly

planted hedgerows and windbreaks. In the San Francisco Bay region this insect ranks first among the pests of *C. macrocarpa*.

It was found in the course of thorough investigation that this scale insect was not originally found on *C. macrocarpa*, but on *Libocedrus decurrens* which occurs in the mountains of California, Nevada, and southern Oregon. From this host plant it has probably spread to *C. macrocarpa* by the transport seedlings of *L. decurrens* or timber to the regions infested.

The characteristic injury caused by this insect begins to makes its appearance on one or two branches and slowly spreads to the rest of the tree. The leaves turn first yellow, then red or brown, giving the tree a dilapidated appearance. After a few years the whole tree dies.

The scale does not depend solely on *C. macrocarpa* and *L. decurrens* for food, but also attacks *C. arizonica*, and *C. guadalupensis*. At Santa Rosa (Calif), a dead male was found on a *Cedrus Deodara*.

The larvae after they are hatched consist of small oval bodies, pale yellow in colour, and active only for a short time after hatching. They attach themselves to crevices in the bark, and are soon enveloped in a white cottony secretion. As they reach maturity they become reddish-brown in colour and nearly spherical in shape.

Oviposition begins in the spring and continues throughout the summer. The eggs hatch into larvae in less than an hour and soon attach themselves to the host. The females reach the adult stage in the autumn, then hibernate, and start laying in the spring. The males appear towards the end of autumn for mating purposes and then die.

Various insects are acknowledged as parasites of the bark scale, none of which however are sufficiently abundant to be a really efficient means of control. Consequently remedial measures have to be adopted. According to the results obtained as the result of spray tests, a 12 ½ % solution of a " miscible oil " spray (1) (33° Baumé) is recommended. The proportions are as follows : 1 part miscible oil to 7 parts water. To obtain complete control, it is necessary to spray twice, one in August and once in the latter part of September.

935 - **Infestation of the White Pine Aphid, *Lachnus strobi* on *Pinus Strobus* in Massachusetts, U. S. A.** — PEIRSON, H. B., in *Psyche*, Vol. XXVII, Nos. 2-3 pp. 62-63. Boston, Mass., April-June, 1920.

Whilst in the Harvard Forest, Petersham, (Massachusetts), the attention of the author was called to a somewhat isolated clump of white-pine trees (*Pinus Strobus*), 40 to 50 years old, which were dying.

On two sides of the clump, which consisted of a dozen trees were young white pine plantations.

A careful examination showed that the trees were being killed as the result of an extremely heavy infestation of black aphids which upon identification proved to be *Lachnus strobi* Fitch., the White Pine Aphid. Many of the larger limbs were barren of foliage, whereas on others the

(1) Soapy emulsions diluted with water. Cf. SANDERSON A. D. Insect Pests of Farm, Garden and Orchard, New York, 1912, p. 50. (*Ed.*)

foliage was brown, the individual needles each showing many puncture marks made by the aphid when feeding.

The tree were first examined on October 10, 1919, at which time the aphids were laying their eggs on the green needles, in a series of straight lines, generally consisting of 5 or 6 eggs per line, but it was not at all uncommon also to find 10 or 15 attached end to end.

As many as 27 eggs were found on a single needle. At this particular period, large numbers of the aphids were still feeding, and these had congregated on the needles and small twigs. The survival of the insects in spite of heavy rains and low temperatures was remarkable; subsequent investigations showed them feeding up till about November 1.

936 - ***Pityophthorus bassetti*** **n. sp. and *P. occidentalis* n. sp., Coleoptera Parasites of *Picea Engelmanni* in Colorado, United States.** — BLACKMAN, M. W., in *Psyche*, Vol. XXVII, N. 1, pp. 1-5, figs, 1. pl. 1, Boston, Mass, 1920.

Morphological details of two new species of *Pityophthorus*: *P. bassetti* and *P. occidentalis*, parasitic on *Picea Engelmanni*, according to observations made in 1915 at Pitkin, Colorado.

P. bassetti can be obtained by breeding according to report, and will also breed successfully in *Abies balsamea*.

In the case of *P. Engelmanni*, the 1 rvae bore into the bark within touching the sapwood ; while in *A. balsamea* on the contrary, the larvae mines are excavated partly from the sapwood.

ALFREDO RUGGERI, *gerente responsabile.*

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BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

937 – **The Antimalarial Rôle of Livestock and Poultry.** — LEGENDRE, J., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 12, pp. 766-769, Paris, March 22, 1920. RURAL HYGIENE

Observations made in Tonkin, Madagascar and in France which confirm the important part played by livestock from the point of view of mosquito bites (1).

The horse, and as a general rule, most mammiferous animals are more readily attacked by mosquitoes than human beings ; rabbits are preferred to pigs ; poultry are only occasionally attacked. Domestic animals attract mosquitoes and therefore guard human beings from malarial infection.

The important efficacious rôle played by the rabbit from this point of view is decidedly worthy of attention, owing to the fact that if it is not possible always to breed big stock, there is never any hindrance to rabbit breeding. Poultry keeping has no value in this respect ; not only do the mosquitoes avoid poultry, but the eggs are never even laid in the drinking troughs.

938 – **The Action of Radium Emanation on the Vitamines of Yeast.** — SUGIURA, K., and BENEDICT, S. R., in *Journal of Biological Chemistry*, Vol. XXXIX, No. 3, pp. 421-433, diagr. 1. Baltimore M. D. October 1919.

As a result of practical experiments with white rats, the authors have come to the conclusion that growth-promoting factors may be inactivated partially by means of exposure to radium emanation. It is possible that the therapeutic effect of radium upon neoplasms may be due in part, at

(1) See analogous observations made by M. ROUBAUD ; R., Jan. 1920, No. 1 (*Ed.*)

least, to this destruction of growth-promoting substance. In these experiments it was found that 2 % of yeast content added to the synthetic ration (consisting in feeds composed of a single chemical substance) seemed to be sufficient to promote normal growth in young rats.

EXPERIMENTAL AND ANALYTICAL WORK

939 – **Resolution and Scheme of a Convention with Regard to the Creation of an International Scientific Commission on Food Supplies.** — *Commission Scientifique Interalliée du Ravitaillement*, pp 1-11. Brussels, 1919.

When peace was signed, the Allied Food Commission which was founded to advise the Allied Governments on all problems of food supply arising from the war, naturally ceased to exist, and when, in the last quarter of 1919 the final reports had been published, the organisation was dissolved (1).

However, the Delegates present at the meeting held in Brussels on May 22, 1919, in accordance with a resolution adopted at the Rome-Naples meeting, held in December, 1918, again decided to call the attention of the various Governments to the utility of retaining an international institution, whose task would be to establish scientific relations between the various organisations engaged in the study of problems relating to food.

This institution would have the following aims :—

(1) To study the production and distribution of foods for human and animal consumption.

(2) To gather data and statistics with regard to the needs of man under all conditions as regards age, sex, work, climate, social conditions, etc. as well as data on the relationship between various diseases and deficiencies of food whether qualitative or quantitative.

(3) To ascertain the chemical composition and calorific value of foods.

(4) To popularise and spread information relating to the best methods of using natural food supplies for human consumption.

As far as possible, the proposed international organisation would cooperate with institutions already in existence for the purposes above named.

In addition, according to the scheme of the convention for the foundation of an International Commission, presented by Dr. Rulot, Belgian Delegate, and M. Alquier, Head of the Permanent Central Secrétariat of the Inter-allied Commission and passed on May 29, 1919, the Allied Food Commission should be recognised by the adhering Powers as the Official headquarters of scientific study and research on alimentation, in order to coordinate and assist all sciences relating to food and facilitate practical applications ; it would be supported by contributions from adherent States. Each State would appoint one or more delegates to the Commission, the delegates to be assisted by a national secretariat.

A permanent Central Secretariat would be formed to maintain close

(1) Commission Scientifique Interalliée du Ravitaillement. Rapport Général. Les Ressource et les Besoins Alimentaires des Pays Alliés. *Rapports I et Annexes II et III*. Paris-Rome, Oct.-Déc. 1018. (*Ed.*)

contact between all Administrations, Institutions and Associations having the same objective as the Commisson.

In brief, the functions of the Commission should be :—

(*a*) To collect and study all information of a scientific, practical and administrative nature concerning, on the one hand, the human food supply and on the other the production and distribution of foods.

(*b*) To consider the standardisation of scientific methods and of unit systems of food production and utilisation, and to consider the choice of a unit method by which scientific work of this kind can be compared.

(*c*) To encourage systematic investigation in the adherent States and to initiate scientific missions.

(*d*) To contribute, with the help of the competent Administrations, Institutions and Associations, to the development, teaching, and propagation of science applied to feeding problems and to issue useful publications to this end.

(*e*) To enable all States represented on the Commission to profit to the fullest extent from the practical results obtained by science, so that each State can take measures when and where necessary for the common good.

The resolutions passed by the Commission are in no way binding on any of the participant States.

CROPS AND CULTIVATION

940 – **Predicting Minimum Temperatures from Hygrometric Data.** — WARREN SMITH, in *Monthly Weather Review Supplement* No. 16, pp. 6-19, figs. 24. Washington, 1920. AGRICULTURAL METEOROLOGY

In the Monthly Weather Review for August, 1917, the author discussed the prediction of minimum temperatures on radiation nights by the use of the following linear equation

$$y = a + bR,$$

using R as representing the evening relative humidity and y as the variation of the night minimum temperature from the evening dewpoint. This equation was applied to hygrometric data obtained at special fruit stations in Ohio, and the results were found to be very satisfactory. According to the records kept at other stations after an attempt to use this equation, the results were not entirely satisfactory. In such cases in reporting the evening relative humidity and the variation of the minimum temperature from the evening dewpoint, it was found that the dots were arranged in the form of a curve, instead of along a straight line, hence the impossibility of applying the linear equation

The next step taken by the author was to determine the coefficients of equation for a parabola curve. The equation of a parabola may be written thus :

$$y = a + bx + cx^2$$

and in order to facilitate matters, the equation might be written as follows :

$$v = x + by + cz$$

in which x y and z are the coefficients to be determined ; b is the evening relative humidity, c = the square relative humidity, and v = the variation of the minimum temperature from the evening dewpoint.

With a view to working out the formula for predicting the minimum temperature the first step is to chart the available data on squared paper on which the evening relative humidity is indicated at the bottom of the diagram, and differences between the dewpoint temperature and the minimum are noted at a prescribed point. A dot is entered on the diagram for each day covered by the record. If the dots arrange themselves in a straight line, the linear equation will be $y = a + b R$, and this has already proved successful in Ohio. If on the other hand the dots form a curve, the data may be represented by the parabola curve formula.

A judicious selection is made of certain "star" points as for example points 1, 2, and 3 in figure 2 of the article reviewed. At 1, the relative humidity is 5 %, and the variation of the minimum temperature from the dewpoint equals 48°. At 2 the relative humidity is 15 % and the variation 28°.

At 3 the relative humidity is 40 % and the variation 9°.

With these data the normal equations are written as in the following table :—

b	v	c
5	48	25
15	27	225
40	9	1600

From this table, the three equatons for solving the unknown factors x, y, and z are expressed as follows :

(1) $\quad x + b_1 y + c_1 z = v_1 y$ ·
(2) $\quad x + b_2 + c_2 z = v_2$
(3) $\quad x + b_3 y + c_3 z = v_3$

The coefficients b_1, b_2 and b_3 represent the 3 values of b in Table 1, viz 5, 15 and 50 ; the values of c and v are the corresponding values of these factors in the given Table.

To determine the values x, y and z, it is preferable to adopt the "direc solution method"

Insert the values under b, v and c in equations (1) (2) and (3) and solv for z as follows :—

(1) $\quad x + 5y + 25z = 48$
(2) $\quad x + 15y + 225z = 27$
(3) $\quad x + 40y + 1600z = 9$

Subtracting equation (2) from equation (1) we get

(4) $\quad -10y - 200z = 21$

Subtracting (3) from (2) we have

(5) $\quad -25y - 1375z = 18$

Multiplying (4) by 5 and (5) by 2, we get, respectively

$$(6) \qquad -50y - 1000z = 105$$
$$(7) \qquad -50y - 2750y = 36$$

Subtracting (7) from equation (6) we have

$$(8) \qquad 1750\,z = 69$$
$$z = 0{,}03943.$$

The next step will be to substitute the value of z in equation (4) or (5) and solve for y.

Substituting in (4) we get :—

$$(9) \qquad -10\,y - (200 \times 0.03943) = 21$$
$$-10\,y - 21 + 7.886$$
$$-10\,y = 28.886.$$
$$y = -2.8886$$

Substituting in (5) it becomes

$$(10) \qquad -25\,y - (1375 \times 0.03943) = 18$$
$$-25\,y = 18 + 54.21625$$
$$-25\,y = 72.21625$$
$$y = 2.88865$$

Substituting the values of y and z in equations (1), (2) and (3) we get the following :—

$$(11) \quad x + (5 \times -2.886) + 25 \times 0.03943) = 48$$
$$(12) \quad x + (15 \times -2.886) + (225 \times 0.03943) = 27$$
$$(13) \quad x + (40 \times -2.886) + (1600 \times 0.03943) = 9.$$

Carrying out the calculation, we have for each equation, respectively

$$x = 61.45725$$
$$x = 61.45725$$
$$x = 61.456 \text{ or an average of}$$
$$x = \mathbf{61.457.}$$

By using these values, we find that :—

$$x = 61.46$$
$$y = -2.89$$
$$z = 0.0394$$

According to the equation

$$v = x + by + cz.$$

the probable variation of the minimum temperature from the evening dew-point (v) can be determined on radiation nights with a fair degree of accuracy.

The parabolic curve will be traced on the diagram by utilising the points already selected and calculating others by this equation. For a relative humidity of 10 %, for example, by inserting the known values of b and c, and the above-determined values for x y and z it becomes

$$(14) \qquad v = 61.46 + (10x - 2.89) + (100 \times 0.0394).$$

and working out the calculation, we find that

$$v = 36.5^{\circ}$$

By the same method the value of v for other relative humidity figures is calculated, and then the curve AB can be drawn.

If trials fail to give a satisfactory parabolic curve, it will be evident that sufficient care was not taken and that the graph is not a parabola but some other curve.

For El Paso (Texas), the parobolic curve in fig. 2 in the article under consideration corresponds exactly with the calculations.

Having discovered the particular dependable formula, the practical work will be facilitated by computing a table giving the necessary values of the minimum temperature based on the known values of b and the dew-point as indicated in the following table.

El Paso, Texas.

$$v = x + by + cz$$

$$x = 61{,}457 \qquad y = -2{,}889 \qquad z = 0{,}03943.$$

b	c	b y	c z	v
5	25	− 14.445	0.986	48.00
6	36	− 17.334	1.3184	45.44
7	49	− 20.223	1.9306	43.16
8	64	− 23.112	2.5216	40.87
9	81	− 26.001	3.1914	38.65
10	100	− 28.89	3.943	36.51
20	400	− 57.58	15.767	19.44
30	900	− 86.67	35.487	10.27
40	1600	− 115.56	63 088	8.99
50	2500	− 144.45	98.575	15.58

The author continues by giving the values and diagrams for the following localities: Boise (Idaho); Chicago University; Cincinnati (Ohio); Grand Junction (Colorado); Montrose (Colorado); Phoenix (Arizona); San Diego (California).

In all these localities, the curve is represented by a parabola obtained in each case by means of the equation $v = x + by + cz$.

An inspection of these curves shows a distinct similarity between them in many cases, and seems to indicate that the equations and factors determined for one place can be used at another place with a similar climate and topographic surroundings

With the variation in climate and in topographical surroundings, even if the curve appears the same, the values of x, y and z are variable. For example, some of the values are as follows:—

Cincinnati (Ohio)	x = 41.1	y = 0.05	z = 0.00275
Montrose (Colorado):	x = 50,8	y = — 2,04	z = 0,016
San Diego (California):	x = 48,3	y = — 1,1935	z = 0,00656
Boise (Idaho)	x = 39.6	y = − 1.482	z = 0.012

An exhaustive study was made by the author to see whether better results could be obtained by using some other hygrometric factors (instead of relative humidity).

Definite results were only obtained when the factor showing the depression of the dewpoint below the current temperature was used and was compared with the variation of the minimum temperature from the dewpoint, and it is hoped that this method may prove useful in connection with forecasts.

941 – **Effect of the Relative Length of Day and Light and other Factors of Environment on Growth and Reproduction in Plants.** — GARNER, W. W. and ALLARD, H. A., in *Journal of Agricultural Research*, Vol. XVIII, No. 11, pp. 553-606, tables 14, pl. 16, bibliogr. of 26 publications. Washington D. C., March 1, 1920.

Results of experiments concerned chiefly with the effect of daily duration of the light exposure on the general growth and development of plants.

A darkened chamber was employed in which the plants growing in small boxes were readily handled.

In the various tests, the length of exposure to light varied from a minimum of 5 hours per day to a maximum of 12 hours. For the 5 hours exposure, the plants were placed in the dark house at 3 p. m. and left there until 10 a. m. the following day; for the 7 hour exposure to light, plants remained in the dark from 4 p. m. until 9. a. m. and for the 12-hour exposure from 6 p. m. to 6 a. m. In certain special cases the plants were kept in the dark house from 10 a. m. to 2 p. m.

In the course of experiment, the plants were exposed to the light :—

1) from the germination of the seed or in the earlier stages of growth, and continued until maturity;

2) till the flowering period;

3) after the flowering period until maturity.

The following species were employed in these tests : — *Soja max* L. (Piper) ; *Nicotiana Tabacum* and *N. rustica* L., *Aster linariifolius* L., *Mikania scandens* L., *Phaseolus vulgaris* L,, *Ambrosia artemisiifolia* L. ; *Raphanus sativus* L. ; *Daucus Carota* L., *Lactuca sativa* L., *Hibiscus Moschentos* L. ; *Brassica oleracea capitata* L. : *Viola fimbriatula* S. M. ; *Solidago juncea* Ait.

In addition to the experiments with the dark house, a series of plantings were made at intervals of approximately 3 days in order that the effects produced by different dates of planting might be compared with those produced by artificially shortening the length of the daily exposure to light.

LENGTH OF DAILY LIGHT EXPOSURE IN RELATION TO VEGETATIVE DEVELOPMENT. — In general, the extent of growth was proportional to the length of the daily exposure to light.

The following Table demonstrates this biometric relationship fo soybeans and the aster.

Apart from the reductions in rate of growth and slight chlorosis, the tobacco, soybeans, and aster showed no ill effects, physiologically speak-

Length of daily exposure	Average height of plants				
	Soybeans				*Aster*
	Mandarin	Peking	Tokyo	Biloxi	
	Inches	Inches	Inches	Inches	Inches
10 a. m. to 3 p. m., 5 hours (I)	6 to 7	5 to 6	7 to 8	6 to 7	—
9 a. m. to 4 p. m., 7 hours (II)	9 to 10	8	7 to 8	11	8 to 10
Sunrise to 10 a. m. and 2 p. m. till dark, 8 1/2 to 11 hours (III)	—	20 to 26	24 to 25	38 to 40	11 to 12
6 a. m. to 6 p. m., 12 hours (IV)	14 to 15	14 to 15	17 to 18	23 to 24	8 to 10
Full daylight, 12 1/2 to 15 hours (V)	18 to 20	40 to 44	42 to 44	54 to 58	14 to 15

ing, from the reduced length of illumination; *Hibiscus*, however, was not able to make any appreciable growth when this period was reduced to 9 hours, and *Lactuca* was much more seriously affected.

Length of daily light exposure in relation to sexual reproduction. — The results obtained with soybeans are particularly interesting. This included 4 varieties ranging from early to very late in maturing. The average number of days from germination to flowering was approximately 27, 56, 70 and 105 respectively for the Mandarin, Peking, Tokyo and Biloxi.

Length of daily exposure	Time from germination to flowering (Days)			
	Mandarin	Peking	Tokyo	Biloxi
5 hours (I)	23	23	24	27
8 hours (II)	21	21	24	26
Do	—	22	27	28
8 1/2 to 11 hours (III)	—	40	62	79
12 hours (IV)	21	21	28	28
12 1/2 to 15 hours (V)	26	62	73	110
Do	28	51	66	90

When the daily illumination consists of a 12 hours exposure, the vegetative period is apparently only slightly shortened in the Mandarin variety, but in the very late Biloxi variety, this period is reduced to less than 1/4 that of the control plants. In reality, all 4 varieties become equally early maturing ones under these conditions. Further shortening of the light exposure period had no remarked effect; apparently therefore the minimum formative period will be approximately 21 days for the Mandarin and Peking varieties, 24 days for the Tokyo, and 26 days for the Biloxi.

As regards the tobacco, the contrast in behaviour between the Connecticut Broadleaf and Maryland Mammoth, and Stewart 70-Leaf Cuban varieties is very striking. Neither sexual reproduction nor the vegetative period in the Connecticut Broadleaf is materially affected by changes in length of exposure to light, either lasting 12-15 hours or limited to 7 hours.

The Maryland variety can only be forced into flowering during the summer months by artificial shortening of the duration of the daily exposure to light. If this lasts 12 hours, this occurs after 75-85 days, and if reduced to 7 hours, after 52-59 days. The Cuban variety was affected in a similar way, while *Nicotiana rustica* shows no material change

From the studies undertaken by the author, it has been found that in a number of species, the plant can only attain the flowering and fruiting stages when the length of day falls within certain limits, and, consequently, these stages are reached only during certain seasons of the year. In the latitude of Washington where the tests were made, some species and varieties respond to relatively long days. The Mandarin soybean demonstrates this fact in that the time required by it to reach the flowering period cannot be greatly reduced by shortening the length of artificial exposure to light. On the other hand, certain varieties respond to relatively short days, for example, the Biloxi soybean is a dintinctively "short day" variety and the Maryland Mammoth Tobacco flowered only during the summer months when submitted to artificial light during part of the day, etc. Still further species appeared indifferent to the length of exposure.

In the absence of the favourable length of day for sexual reproduction, vegetative development may continue more or less indefinitely, thus leading at times to the phenomenon of gigantism: Lodewijks discovered a giant type of Sumatra tobacco, grown under the influence of the 12-hour equatorial day, which may reach the height of 24 ft., either without flowering or forming only a very limited number of flowers and seeds. These forms of gigantism disappear if the plant is brought under the influence of short days such as prevail in the temperate zone during winter. For example, the Maryland Mammoth tobacco retains a normal appearance during winter.

On the other hand, under the influence of a suitable length of exposure to light, precocious flowering and fruiting may be induced, and certain varieties may act as early or late maturing.

The relationships existing between annuals, biennials and perennials are dependent to a large extent on the length of day in the locality concerned, and by artificial regulation of this factor, the normal annuals may complete two cycles of alternate vegetative and reproductive activity in a single season. For example: the Biloxi soybean, was kept in the dark house up till the flowering period, and consequently, when restored to normal conditions, the seed pods ripened rapidly, the leaves faded as if the plants were dying; the effect of the long summer days was to encourage the development of new shoots which flowered in the early part of September.

Experiments reported indicate that light intensity is of secondary importance so far as concerns the attainment of the flowering stage.

Effect of shading soybeans.

Treatment	Average Height	Air-dry weight per stalk defoliated	Yield of beans per stalk	Yield of hulls per stalk	Percentage of beans in seedpods	Date of flowering
		gr	gr	gr		
Plants shaded . . .	3 ft. 5 in.	5.4	10.5	5.4	66.1	Aug. 7
Plants not shaded .	2 ft. 3 in.	9.4	17.0	9.0	65.2	Aug. 7

The effect of direct light on the growth and development of the plant and on the yield is evident ; the date of flowering was not in the least affected.

Variations in the water supply, ranging from optimum to a condition of drought sufficient to induce temporary wilting, did not however influence the date of flowering.

It may therefore be concluded that the " length of the day " is an important factor in the natural distribution of plants, and should be taken into account in connection with crop production. Fruiting may be cut short by the effect of too long or too short a day. By introducing a species from one latitude into another, or by changing the time of sowing, good results may be obtained, but may also bring about misleading results. These are matters of vital importance both to the plant breeder and the agronomist. To obtain maximum yields, it is essential that the date of sowing be so regulated that the optimum length of day coincides with the critical stage of the floral development.

Conclusions. — Sexual reproduction can be attained by the plant only when it is exposed to a specifically favourable length of day (this varies widely with the species and variety). A length of day unfavourable to reproduction, but favourable to growth, tends to produce gigantism or indefinite continuation of vegetative development. However, exposure to a length of day favourable alike to development and reproduction, encourages the uninterrupted type of flowering and fruiting.

The authors suggest the term *photoperiod* to designate the favourable length of day for each organism, and *photoperiodism* to designate the response of the organisms to the relative length of day and night.

942 - **New Methods for Determining the Correlation Coefficients Between the Growth and Yield of Winter Wheat in Ohio, U. S.** — Blair, T. A. in *Monthly Weather Review*, Vol 47, No. 12, pp. 841-847. Washington, Dec. 1919.

Concerning the methods of computing the relationships between weather and biological value (vitality, growth, yield, etc.), the author has made use of a linear regression equation by which the biological value is expressed as a function of a fixed number of weather elements (3 to 6).

The equation may be expressed as follows :

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + \ldots \quad (1)$$

in which Y is the biological value; $x^1, x^2, x^3, x^4 \ldots$ are the various weather elements (mean temperature, total precipitation, percentage of sunshine, etc.) expressed numerically; a, b_1, b_2, b_3, $b_4 \ldots$ are numerical quantities, having a constant value for a given equation to be determined from the data.

The equation may first be simplified by the elimination of a as follows: the normal equation for a (obtained by multiplying each of the equations under consideration by the coefficient of a, in this case unity, and taking the sum) may be expressed thus:—

$$\Sigma Y = n a + \Sigma b_1 x_1 + \Sigma b_2 x_2 + \Sigma b_3 x_3 + \Sigma b_4 x_4 + \ldots \quad (2)$$

from which

$$a = \frac{\Sigma Y}{n} - \frac{\Sigma b_1 x_1}{n} - \frac{\Sigma b_2 x_2}{n} - \frac{\Sigma b_3 x_3}{n} - \frac{\Sigma b_4 x_4}{n} + \ldots \quad (3)$$

Substituting this value in the original equation gives:—

$$Y - \frac{\Sigma Y}{n} = \left(x_1 + \frac{\Sigma x_1}{n}\right) b_1 + \left(x_2 + \frac{\Sigma x_2}{n}\right) b_2 + \left(x_3 + \frac{\Sigma x_3}{n}\right) b_3 + \left(x_4 + \frac{\Sigma x_4}{n}\right) b_4 + \ldots \quad (4)$$

Now as $Y - \frac{\Sigma Y}{n}$, $x - \frac{\Sigma x_1}{n}$, are in each case the differences between the values for the individual years, and the average values of the same quantities, that is to say, are the departures from the means. Designating these departures by y, D_1, D_2, D_3, D_4 (y = departure from average yield; D_1 = departure from mean temperature, October to November etc.) we have for the final form of the equation:—

$$y = b_1 D_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + \ldots \quad (5)$$

From equation (5), the normal equations become:—

$$\Sigma D_1 y = b_1 \Sigma D_1^2 + b_2 \Sigma D_1 D_2 + b_3 \Sigma D_1 D_3 + \ldots$$
$$\Sigma D_2 y = b_1 \Sigma D_1 D_2 + b_2 \Sigma D_2^2 + b_3 \Sigma D_2 D_3 + \ldots$$
$$\Sigma D_3 y = b_1 \Sigma D_1 D_3 + b_2 \Sigma D_2 D_3 + b_3 \Sigma D_3^2 + \ldots$$

It is then necessary to prepare tables of the data used, together with the departures, squares of departure, and products of departures appearing in the normal equations. These equations should be solved simultaneously for the values of b_1, b_2, b_3, b_4. Where the number of equations exceeds 3, the solution is more easily performed by writing the required values in the form of determinants, and reducing these to the second order, before expanding.

This method possesses distinct advantages over that of partial correlation coefficients, especially as regards the effect of the several factors considered, expressed directly in an equation from which a general idea is at once obtained as to the relative importance of each of the factors under consideration.

Winter wheat in Ohio is sown in September and harvested in July. Being given, however, the length of the growing season and the multiplicity

of factors that may be expected to affect the growth of wheat, the author compares the relative values of weather factors, affecting the condition of winter wheat from sowing to harvest:— (1) from sowing time to December 1; (2) from December 1 to April 1, (3) from April 1 to May 1; (4) from May 1 to June 1.

1	2	3	4	5	6	7	8	9	10	11	26	27
Year	Reported condition December 1, (%)	Departure	Temperature October-November, F.	Departure	Precipitation September (inches)	Departure	Precipitation October-November (inches)	Departure	Sunshine October-November	Departure	Calculated condition %	$Y-Y_1$ %
	Y	y	x_1	D_1	x_2	D_2	x_3	D_3	x_4	D_4	Y_1	
1893	92	+ 1	46	— 1	1.6	— 1.1	6.3	+ 1.3	44	— 4	89	— 3
1894	93	+ 5	46	— 1	3.3	+ 0.6	4.2	— 0.8	54	+ 6	85	— 8
1895	74	— 14	44	— 3	1.7	— 1.0	5.3	+ 0.3	52	+ 4	81	+ 7
1896	101	+ 13	47	0	5.1	+ 2.4	3.8	— 1.2	46	— 2	91	— 10
1897	—	—	50	+ 3	0.8	— 1.9	7.2	+ 2.2	51	+ 3	—	—
1898	102	+ 14	46	— 1	2.6	— 0.1	6.9	+ 1.9	40	— 8	93	— 9
1899	83	— 5	50	+ 3	2.7	0	3.8	— 1.2	47	— 1	89	+ 6
1900	86	— 2	51	+ 4	1.8	0.9	6.1	+ 1.1	48	0	92	+ 6
1901	75	— 13	46	— 1	2.9	+ 0.2	2.2	— 2.8	52	+ 4	79	+ 4
1902	98	+ 10	52	+ 5	4.0	+ 1.9	4.9	— 0.1	42	— 6	99	+ 1
1903	80	— 8	46	— 1	1.5	— 1.2	4.7	— 0.3	51	+ 3	82	+ 2
1904	76	— 12	46	— 1	2.0	— 0.7	1.9	— 3.1	46	— 2	79	+ 3
1905	98	+ 10	46	— 1	2.9	+ 0.2	6.2	+ 1.2	46	— 2	90	— 8
1906	97	+ 9	47	0	2.9	+ 0.2	5.8	+ 0.8	39	— 9	93	— 4
1907	84	— 4	44	— 3	3.9	+ 1.2	4.7	— 0.3	52	+ 4	86	+ 2
1908	62	— 26	48	+ 1	0.0	— 2.1	2.3	— 2.7	60	+ 12	75	+ 13
1909	95	+ 7	49	+ 2	1.8	— 0.9	4.8	— 0.2	54	+ 6	86	— 9
1910	91	+ 3	46	— 1	4.9	+ 1.3	6.1	+ 1.1	44	— 4	93	+ 2
1911	83	— 5	46	— 1	4.9	+ 2.2	7.9	+ 2.9	38	— 10	101	+ 18
1912	95	+ 7	48	+ 1	3.1	+ 0.4	3.5	— 1.5	58	+ 10	84	— 11
1913	99	+ 11	49	+ 2	2.4	— 0.3	6.9	+ 1.9	41	— 7	95	— 4
1914	94	+ 6	50	+ 3	1.4	— 1.3	4.9	— 0.1	51	+ 3	87	— 7
1915	85	— 3	50	+ 3	4.5	+ 1.8	5.1	+ 0.1	56	+ 8	93	— 8
1916	87	— 1	48	+ 1	3.0	— 0.1	4.2	— 0.8	61	+ 13	83	— 4
1917	83	— 5	43	— 4	1.9	— 0.8	5.3	+ 0.3	41	— 7	84	+ 1
Sum.	2113	+ 1	1184	+ 9	67.5	0	125.0	0	1214	+ 14	2109	— 20
Mean.	88.0	—	47.4	—	2.70	—	5.00	—	48.5	—	87.9	— 0.8

The Bureau of Crop Estimates gives the estimated condition of the various crops on the first day of December, April, May, and June. This is expressed as a % of the normal (represented by 100). The normal is defined as "a condition of perfect health unimpaired by drought, hail, insects,

or other injurious agencies " and is somewhat better than the average but always inferior to the optimum condition as indicated by figures over 100.

The condition reports are available for a 25 year series (1893 to 1917) (see Table) and deal with the relative values of weather factors and the development in growth of winter wheat at various dates.

The Table illustrates the relative values of the condition on December 1 and the condition of the crops later.

Columns 12 to 25 (not reported owing to lack of space) contain squares and products of departures from which the following sums are obtained :

$$\sum D_1^2 = +131 \qquad \sum D_2 D_3 = +4.01$$
$$\sum D_2^2 = +37.44 \qquad \sum D_2 D_4 = -52.8$$
$$\sum D_3^2 = +58.24 \qquad \sum D_3 D_4 = -137.2$$
$$\sum D_4^2 = +1.048 \qquad \sum D_1 y = +128$$
$$\sum D_1 D_2 = -1.3 \qquad \sum D_2 y = +109.2$$
$$\sum D_1 D_3 = +2.7 \qquad \sum D_3 y = +173.6$$
$$\sum D_1 D_4 = +63 \qquad \sum D_4 y = -627$$

Normal equations

$$128 = 131\, b_1 - 1.3\, b_2 + 28.7\, b_3 + 63\, b_4$$
$$109{,}2 = -1.3\, b_1 + 37.44\, b_2 + 4.01\, b_3 - 52.8\, b_4$$
$$173.6 = 2.7\, b_1 + 4.01\, b_2 + 58.24\, b_3 - 137.2\, b_4$$
$$-627 = 63\, b_1 - 52.8\, b_2 - 137.2\, b_3 + 1.048\, b_4$$

Solving :

$$b_1 = 1.1 \qquad b_2 = 2.3 \qquad b_3 = 2.1 \qquad b_4 = -0.3.$$

Substituting in equation (3) : $a = 33.8$.

Substituting in equation (1) :

$$Y = 33.8 + 1.1\, x_1 + 2.3\, x_2 + 2.1\, x_3 - 0.3\, x_4.$$

Substituting the values of x_1, x_3, x_3, x_4, for individual years (see Table), we get the calculated condition of December 1 as given in column 26.

In the linear equation the numerical values are expressed relative to the units employed, namely :— inches, degrees, percentage, etc. To obtain an idea of the relative importance of the coefficients b_1, b_2, b_3, b_4... the unit must be eliminated by multiplying each by its standard deviation, ; the values are then $b_1\,\sigma_1$, $b_2\,\sigma_2$, $b_3\,\sigma_3$, $b_4\,\sigma_4$, and these give an idea of the relative values of the various factors to which they refer.

The values of b_6 calculated for the entire season under consideration, leads to the following general conclusions : —

1) to ensure vigorous growth of winter wheat, temperatures should be above normal from October to March inclusive (especially in March), and temperatures below normal in May ;

2) precipitation above normal from September to November, inclusive, below normal from December to March ;

3) he amount of sunshine in October, November, March and May, and the amonht of snow in March are relatively unimportant factors.

As regards the yield apart from the general conditions of development,

in some cases opposite effects have been notified. This is thought to be due to the fact that at certain critical stages of growth the vigour prevents a heavy yield of seed.

In every case, after examination of each month's record and at recognised fixed intervals, a diversity of fairly low correlations will be noted in the various localities. The existence of the critical stages having been established, the results are not surprising. These stages may extend over a single season, and as these may occur at quite different times, even within limited areas, the same meteorological phenomenon can determine very different effects according to the condition of development of the plant under inspection.

After due consideration of these points, the author examined the data (meteorological and yield) in Fulton County for the following periods: April 6 to 15 ; April 16 to 25 ; April 26 to May 5 ; May 6 to 15 ; May 16 to 25 ; May 26 to June 4 ; June 5 to 14 ; June 15 to 24 ; June 25 to July 4.

The resulting regression equation obtained for the 3 thermic values (t_2 t_3 and t_8) was as follows:

$$Y = 0.53 + 0.14\,x_2 - 0.51\,x_3 + 0.52\,x_8.$$

The reason for these high coefficients may be attributed to the fact that the above mentioned periods (after due investigation) coincide with the critical stages of growth of the winter wheat, namely : —

1) April 16 to 25 corresponds with the latter part of the tillering stage ; in order therefore to ensure good stooling in the Fulton County, relatively warm weather is needed ; hence the existence of a positive correlation between temperature and yield at this period ;

2) April 26 to May 5 corresponds with the beginning of the rapid growth in height and formation of internodes (jointing stage) ; at this time, cool weather is essential to avoid excessive vigour which would be liablel to have a detrimental effect on the grain yield ; hence the large negative relation ;

3) June 15 to 24 corresponds to the stage and to the early stages in the caryopsis development. If this process is normal, warm weather is desirable ; hence the existence of a distinctly positive correlation.

Results obtained in the Counties of Madison, Franklin and Pickaway in Central Ohio (much further south than Fulton County) confirm the possibilities of limiting the grouping of values to short periods (decades)

$$Y = 2.97 - 0.46\,x_1 - 0.58\,x_2 + 0.42\,x_3 + 0.33\,x_4 - 1.97\,x_5 \qquad (7)$$

in which x_1 = temperature, May 1-11 ; x_2 = temperature, May 22-31 ; x_3 = temperature, June 1-10 ; x_4 = temperature, June 21-30 ; x_5 = precipitation, May 12-21.

The first decade of May corresponds with the jointing period, and in this case a very marked negative relation exists as in Fulton County. The same may be said for the period, which in central Ohio, occurs in the early part of June ; in this case as in Fulton there is a distinct positive correlation.

On the other hand, in central Ohio, situated much further south, in a warmer climate, there is a negative relation at the flowering period while Fulton County where the climate is cooler, fails to show this relation definitely.

The following general conclusions may thus be drawn :—

1) For the State of Ohio, as a whole, a warm March and June, and a cool and dry May, are favourable conditions for a high yield of winter wheat ; all other monthly temperature and precipitation values may be disregarded ;

2) certain periods appear to correspond with critical stages in growth, particularly as regards temperature ; *e. g.* April, May and June ;

3) in Northern Ohio (Fulton County) and in central Ohio, the weather should be cool during the jointing stage and warm when the ear is forming ;

4) in Fulton County, during the last part of the stooling process it should be warm ; it should be cool in central Ohio during flowering, and warm when the grain is ripening ;

5) in Fulton County and probably also in other counties subject to heavy snow falls, where the snow remains long on the ground it is decidedly detrimental.

943 – **The Effect of Weather on Alfalfa Hay and Alfalfa Seed Growing in Western South Dakota and in Utah, U. S.** — I. Johnson, H. N., in *Monthly Weather Review*, Vol. XLVII, No. 5, pp. 325-329 + 3 figs. — II Alter, J. C., *Ibid*, pp. 330-332. Washington, May 1919.

I. — The climate of western South Dakota is especially favorable for growing alfalfa ; as 73 % of the annual rainfall (15 to 20 in.), falls during the period from the beginning of April till the end of September ; the percentage of sunshine is high, end extends over a long period, the rate of evaporation is comparatively low and moderate temperatures usually prevail.

The soil is deep, rich, and retains moisture well. Alfalfa needs a considerable amount of water during the growing period, but fair weather while the hay crop is being harvested. Special weather forecasts are issued during the cropping season in the interests of farmers which enable them to determine how much hay can be cut and cured before the rain is likely to occur.

Seed is usually produced from the second crop when the season is relatively dry. If there is considerable rainfall, the second crop is also utilised for hay, and a third crop is frequently possible. If it is too dry after the first crop has been harvested, growth is checked, and there is a danger of frost injury to seed in the early autumn.

A frost-warning service is therefore established and is widely utilised by seed growers.

II. — The first crop of alfalfa is usually cut for hay in Utah, and the second crop is allowed to run to seed. The seed crop should have sufficient moisture during its early growth to produce a vigorous healthy plant, but the weather should be dry and not too warm while the plants are in bloom.

The dry spell must not be too extended, however, as the seed must have sufficient moisture while setting to give normal size and weight.

Definite comparisons with the yield show that the best results are obtained when the spring temperature averages from 3° to 5° F. a day above normal, and from 2° to 4° F a day below normal.

It takes nearly twice as long to grow and mature a seed crop as it does a hay crop. Seed is usually ready for harvest in Utah one or two weeks in advance of the first autumn frosts. Temperatures of 26° to 28°F will seriously damage partially ripe and unripe seed burrs : hence the importance of minimum temperature forecasts, especially in years when the formation and development of the seeds has been hindered for some reason or other.

The usual practice is to cut as large an area as possible on the receipt of frost warnings, but the first cold period is often followed by several weeks of fine ripening weather.

The use of irrigation and mulches has been fairly well demonstrated in many districts, and efforts should be made to protect the plants from frost damage without cutting, as soon as the warning is received.

The cost is entirely compensated for by the value of the seed and the consequent high prices obtained for the grain produced.

944 – **Effect of Climate of Tonkin on the Yield of Different Varieties of Coffee.** — See No. 988 of this *Review*. (Ed.)

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

945 – **Résumé of Work Connected with the Relations Existing between Soil and Water Content.** – KEEN, B. A. (Goldsmiths' Company's Soil Physicist, Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. X, Pt I, pp. 44-61, tables 13, figs. 2. Cambridge, Jan., 1920.

The relations existing between soil and its moisture content are subject to so many variable factors that separation for purposes of discussion is only possible in a very general way. According to the author, the former classification of soil water as : (1) hygroscopic moisture ; (2) capillary water ; (3) gravitation water, is too empirical for a theoretical basis in connection with colloidal hypothesis. In this paper, therefore, results are specially noted as given in the comparatively few recent papers in which the colloidal hypothesis is accepted, although those dealing with the old theory are also mentioned.

Investigations are reviewed under the following headings :

I. *Soil moisture in general.* — (*a*) The maximum water capacity and pore space ; (*b*) the permeability of soil ; (*c*) capillary effects and the "water retaining capacity"; (*d*) capillary movement of soil water ; (*e*) hygroscopic moisture in soils. From the numerous experiments carried out by soil experts special attention can be given to the results obtained by CRUMP, showing that the organic material has considerable influence on the total amount of water held. Over the whole of the experiments, it was found that the ratio water content was very nearly constant for any one type of soil. This constancy persisted when varying depths of soil were separately examined, in spite of the considerable difference in actual moisture content. Also, it was noted that capillary effects are very dependant upon the nature

of the surface pore spaces (1). The flocculated structure induced by acids and lime, and the deflocculation with alkalis were shown directly to affect such physical factors as the drainage conditions, aeration, and the capacity of the soil to hold the soil solution, and control its movement through the soil (PATTEN and WAGGAMANN).

With regard to the hygroscopic moisture, the author suggests that the subject could be profitably re-opened in the light of present knowledge of colloidal phenomena. Reference is made to the historical summary of work of hygroscopicity given by ALWAY, KLEINE and MC DOLE (2).

II. *Attempts to obtain a more complete theory of soil moisture relations.* — Investigations have followed, in the main, two lines, those on the' ' wilting coefficient " and on the " moisture equivalent ", and the latter gives a better quantitative comparison of soils than the water retaining capacity mentioned above. Experiments by SHULL with *Xanthium* seeds, point to the fact that the wilting coefficient must be regarded as a measure of the water in the plant, and not in the soil at the time of wilt, and the cause of wilting is due to the slow movement of soil moisture.

III. *Surface forces in soils and the colloidal hypothesis.* — The point which needs emphasis in all studies of soil solutions (3), is the recognition that the system soil + solution must be treated as a whole. In this section, the papers discussed are characterised accordingly. Experiments show the importance of emphasizing the above point. A change in the moisture content is reflected in the resulting alteration of all the complex variables involved. Conclusions based on an examination of soil solution after it has been removed from the soil, cannot be regarded as necessarily quantitative, and it is open to doubt whether they are always qualitative. Hence the advisability of study from the colloidal point of view.

946 – **Soil alkali** (4). — HARRIS, F. S. *Circular* No. 41, *Utah Agricultural College Experiment Station*, pp. 1-8. Logan, Utah, Jan., 1920.

In general it may be said that soils containing more than 0.5 % soluble salts where the larger part is composed of chlorides, carbonates or nitrates, and 1 % where sulphates predominate, are unsuitable for crop production without reclamation. These figures are of course modified by many conditions.

The crops to raise on alkali land depend on the degree of salinity of the soil, the uses that can be made of the crops, the markets, and other economic conditions as well as the climatic factors. Among the ordinary farm crops the smaller grains can usually be raised to about the best advantage, As a type of cropping for Utah alkali land, three crops were found suitable. used in rotation on damp medium alkali, namely:— sweet clover, sugar

(1) See *R.*, 1920, N. 387. (*Ed.*)

(2) See *R.* 1917, No. 1114 and *R.*, 1918, N° 128, and *Journal of Agricultural Research*, No. 11 (1917), p. 247.)

(3) See *Soil Conditions and Plant Growth* 3rd edition, 1917, p. 104 by E. J. RUSSELL (Longmans). (*Ed.*)

(4) See *R.*, May 1919, No. 564. (*Ed.*).

beets, and barley. Legumes as a class do not do well and maize and potatoes are also not usually successful.

To prevent alkali from becoming more serious, the author suggests: (1) The cutting off of seepage water from higher land; (2) reduction of evaporation from the surface land by cultivation and a consequent rise of salts from lower depths; (3) constant cropping; (4) the use of manure to reduce surface evaporation; (5) the proper use of irrigation water.

Native vegetation and a chemical analysis of the soil to a depth of at least 6 feet make an excellent combination in determining the degree of contamination of alkali land.

947 – **Soil Reaction as Influenced by Green Manures** (1). — HOWARD, L. P. (Rhode Island Agricultural Experimental Station), in *Soil Science*. Vol IX No. 1, pp. 27-29, tables 7, Bibliogr. of 15 publications. Baltimore, Jan. 1920.

A brief review by the author of the literature dealing with the practice of green manuring serves to indicate that the quantitative evidence for and against this question is very limited. This is followed by results of work on soil samples collected at various periods during the season at Rhode Island Station 1915 and 1916, showing the changes in acidity, and also in organic matter on a legume and non-legume plat. Samples were taken at frequent intervals from the date of ploughing, and lime measurements then made.

This work showed that variations are maintained in dried soils as manifested in their ability to retain different amounts of ammonia.

The net result over the period of 2 years indicates a decreased acidity except in the legume plat and suggests that the rye caused an increased requirement of 33 lb., while the legume caused an increase of 370. It should be noted that the last application of lime was made in 1914 in 1 ton of finely ground limestone per acre when considering net changes in lime requirement during 1915 and 1916.

With regard to hydrogen-ion concentration in soils (1) it is significant that with the rye plat the variations follow in a general way the fluctuations in lime requirement.

In the uncropped soils treated in the laboratory with an equal weight of green rye as compared with clover, the rye increased the lime requirement 300 to 400 lb., or about twice as much as the clover, and the increase was maintained from July to December.

The author considers it advisable to state that these results were scarcely an index of the net cumulative effect exerted by the cover crops through a longer period of time.

948 – **Formation of Nitrate in a Soil Following the Growth of Red Clover and of Timothy.** — LYON, T. L., BIZZELL, J. A. and WILSON, B. D., in *Soil Science*, Vol. IX. No. 1, pp. 53-64. Tables 8, Bibliogr. of 10 publications. Baltimore, Jan. 1920.

The authors first give a brief review of former experiments, but state that the results reported leave some doubt whether the legumes used in-

(1) See *R.*, June 1918, No. 626, and *R.*, July 1918, No. 739. (*Ed.*)

creased the nitrifying power of the soil for dried blood, as compared with the influence of non legumes, except when crop residues alone were concerned, and favour of the legumes was unanimously expressed. The authors deal with the question in a new way and the experiment described involved the leaching of soil on which different crops were growing.

Twelve cylinders were fitted with soil of medium fertility and good drainage qualities, limed and fertilised with acid phosphates, muriate of potash and dried blood. Six were planted with timothy and six with red clover. The soil of all the cans was inoculated with a pure culture of *Bacillus radicicola* from clover nodules. Each also received 1000 cc. of an infusion made by stirring 1 lb., garden soil with 3 litres of tap water to insure an active nitrifying flora.

During the growing period, the soil was leached with distilled water periodically. After these crops were removed, the soil was allowed to remain in fallow for a month Oats and maize were then planted, but cylinders kept free from vegetation. Leaching was continued from time to time and nitrogen determinations made in every case.

The experiment brings out certain data which may be significant. Under the same conditions of soil and treatment, clover caused a greater production of available nitrogen than timothy. The effect is shown in the nitrate content of the drainage water and the total nitrogen content of the oats and maize. Furthermore, only a minor part of the total nitrogen probably remaining in the roots of the clover crop was nitrified before the rate of nitrate production in the clover soil fell to that of the timothy soil.

949 – **The Washing out of Nitrates by Drainage Water from Uncropped and Unmanured Land** (1). — RUSSELL, E. J. and RICHARDS, E. H. (Rothamsted Experimental Station). in *The Journal of Agricultural Science*, Vol. X, Pt I, pp. 22-43. tables 7. figs. 6. Cambridge, Jan. 1920.

The authors have based their work on analyses made by the late N. H. J. MILLER. In 1870 the famous drain gauges were constructed at Rothamsted by Lawes and Gilbert, and a series of measurements were begun of the amount and nitrate content of water draining through uncropped and unmanured land. The soil in the gauges is still in its natural condition.

Broadly speaking results show that uncropped land steadily and persistently loses nitrogen in the form of nitrates. If the curve showing the rate of fall continued its present course and without further slowing down, no less than 150 years would be needed for exhaustion of the nitrogen. So far as can be ascertained the nitrogen lost from the soil appears wholly as nitrate in the drainage water. Measurements of the amount of nitrate washed out from the gauges and its relation to external conditions between the years 1877 and 1915 in 4 year periods show that the quantity of nitrogen as nitrate washed out for every inch of rain was till 1901 1.0 to 1.2 lb., per acre, and since then fell to 0.73 lb.

Rainfall obviously shows a closer relationship than any other single factors to the nitrate in drainage water. The relationship between the

(1) See *R.*, Jan. 1917, No. 8. (*Ed.*)

amounts of rainfall and percolation, and the washing out of nitrates, show that this is more marked in summer than in winter, according to the figures as plotted for individual months. Further figures showing the effect of very dry years and very wet years on losses of nitrates from soil, signify that these losses are nearly proportional to the rainfall. Closer inspection of the data, however, shows that exceptional seasons have after effects which persist the following season.

The effect of temperature is less obvious, but a relationship is seen between the nitrate in the drainage water and the sunshine of the preceding summer. The loss tends to be higher after a hot summer than after a cold one.

The curve showing the rate of washing out of nitrate from the soils of the drainage gauge is very different from the curve for the rate of accumulation of nitrate in soils under fallow conditions. Records show that the loss exceeds 30 lb., per acre in the latter case, compared with 20 lb., from the drainage gauges. The chief difference between the field soil and the gauges apparently lies in the fact that the field soil, even though unmanured and lying fallow for one year, receives annual additions of easily decomposable organic matter in the form of weeds and stubble of the preceeding years' crop, while the soil of the drain gauge does not. At the present time the figures are :

	Percentage of nitrogen in top 9 inches
Drain gauge	0.090
Broadbalk unmanured plot	0.088

Lb., per acre (top 9 inches)

	20 inch. gauge	60 inch. gauge
Present in 1880	3500	3500
Present in 1917	2376	2328
Loss from top 9 in	1124	1172

The total amount of nitrogen in the drainage water from the gauges during the period of 38 years (1877-1915) in which continuous determinations have been made, shows the close similarity between the 1170 lb. of nitrate washed out from the 20 inch. gauge and the 1141 lb., washed out from the 60 inch. gauge, and thus indicating that the nitrate comes only from the surface layers, and not at all from the lower depths. Analysis of the soil at the beginning and end of the experiment, shows how much nitrogen has been lost from the top 9 inches of soil.

Determinations have also been made during 27 years, of chlorine in rain water and in drainage water. This affords by far the best check on the accuracy of working. If the records are accurate, the total amount of

chlorine found in the drainage water should equal that found in rain water for the same period. A table shows how complete is the agreement, the average per annum of chlorine per acre in rain water = 16.35 lb., and also the same figure is given for the amount in drainage soil (20 inch. gauge).

Records prove that the nitrate in drainage water accounts for practically all the nitrogen lost from the soil, and the chief, if not the sole action, in this soil, where there is no manure, crop residues or fresh supply of organic matter, is the production of nitrate. The nitrogen cycle becomes more complex when organic matter is added.

950 – **Loss of Nitrogen in the Soil due to Spring Rains.** WAIBULL, M., in *Landtmannen, Tidskrift for Landtmän*, Vol. XIII No. 26, pp. 422-423. Stockholm, June 26, 1920.

The present article gives the results of a series of experiments made at the Agricultural Station at Alnarp (Sweden) with a view to establishing the extent to which the heavy spring rains cause soil erosion and wash away the nitrates.

The nitrate content of the drainage water was determined in the following plots under rotations: (1) Spring cereals (barley, oats, and wheat-rye mixture) given no nitrogenous fertilisers, on sandy clay soil; (2) sugar-beet treated at the beginning of May with 160 kg., of calcium nitrate on the surface; (3) Pansar wheat treated at the beginning of April with 100 kg., of calcium nitrate on the surface; (4) field peas treated at the beginning of April with 60 kg., of calcium nitrate in sandy-clay soil, (5) forage crops, not manured, on sandy-clay soil. The total area of the plots was about 60 hectares, the soil was slightly alkaline, and the subsoil, of drift clay, was almost always calcareous.

The rains during April and May of that year were very heavy, especially, in May, the average fall per month being 266 mm. (about 10 inches), which is double the average; the worst days were May 6 with 29 mm. and May 25 with 59 mm.

The following table gives the number of grammes of nitrogen per hectolitre of drainage water from the various plots: —

	Spring cereals	Beet	Wheat	Peas	Fodder
May 15 . . .	1.85	1.9	1.5	1.4	undetermined
May 26 . . .	1.90	1.8	0.75	1.4	0.7

The quantity of nitrate, washed away in this water from 1 kg. of soil was, in kg. per hectare:

Spring cereals	37 kg.	=	280 kg., of calcium nitrate
Beet	36 »	=	280 » » » »
Wheat . . .	15 »	=	110 » » » »
Peas	28 »	=	210 » » » »
Forage crops .	93 »	=	70 » » » »

It will be seen that the greatest loss was sustained by sugar-beet and the spring cereals, followed closely by peas. Wheat sustained a smaller loss and forage crops still less. All the losses are considerable, however, and must have a bad influence on the crops. But, in order to answer this question, the nitric nitrogen content of the soil must be ascertained.

Towards this end the author compares the nitric nitrogen content in 1920 with the averages for 1907-1911. The following table gives the average content per million parts in the soil for the period 1907-1911, and for the year 1920.

Plot	Middle of May		Ende of May		Begenning of June	
	1907-11	1920	1907-11	1920	1907-11	1920
Spring cereals . . .	9	9	8.5	3	3.5	3
Sugar beet	2.5	11	10.5	8	7	6
Wheat	2.5	2.5	1	1.5	3	1
Peas	8	5	7	3.5	6.5	2.5

During the first half of May, 1920, in spite of the heavy April rainfall, the nitric-nitrogen content of the soil was nearly up to the normal average of the years 1907-1911 : on the other hand, at the end of May and even during the first days of June, the difference was considerable, especially with the wheat and peas, the amount being only ⅓ of the normal.

951 – **Protozoan Fauna of Soils of New Jersey.** — Fellers, C. R. and Allison F. F., in in *Soil Science*, Vol. IX, pp. 1-25, Pl. 1, Bibliogr. of 30 publications. Baltimore, Jan. 1920.

A review of previous investigations in soil protozoa has already been given (1), but in the present case the principal thesis is connected especially with the *character* of soil microfauna, and embodies the main results obtained from an extended period of research and observation carried out on many soils with several media, and at different seasons. The depth of soil taken for samples, excludes the strictly surface forms. Poor sandy acid or forest soils contained the least number of protozoa species in comparison with fertile soils (2) or those with high water holding capacity.

Of the 104 species identified, the ciliates were the most numerous, followed in order by flagellates, rhizopods and heliozoa. In point of actual numbers in the soil, however, flagellates easily rank first.

The author reviews the opinions previously given with regard to the new theory of distribution of protozoa in the soil to replace the former " egg and germ " theory. His own work supports the views of Koch and Waksman (3), namely, that in ordinary soils there are very few living protozoa even though the same soil may contain thousands of cysts per gram. In the examination by the author of some hundred fresh samples, only two were found to contain living protozoa. It is concluded that in soils not con-

(1) See *R.*, June 1917, No. 619.
(2) *R.*, May 1915, Nos. 579 and 580.
(3) *R.*, Feb. 1916, No. 269. (*Ed.*)

taining moisture much in excess of the physical optimum, protozoa exist mainly in a non-trophic state and are characterised by simple, hardy forms, capable of encystation, or otherwise, to withstand extremes.

In soils saturated with water for several hours, or in standing water, the limited numbers found have very little importance from the standpoint of soil fertility. In fresh water the fauna was much more varied than in the soil, and included rotifers, crustaceans, diatoms, suctoria, sponges, etc.

Much controversy has arisen concerning the question in general but under certain conditions it cannot be denied that protozoa might be able to decrease the fertility of a soil by destroying the beneficial soil bacteria.

In the plates appended to this paper the more common soil protozoa and algae are roughly pictured.

952 – **Ectotrophic Mycorhizal Connections between *Boletineae* and Certain Trees.** (1). — PEYRONEL, B, in *Le Stazioni sperimentali agrarie italiane*, Vol. III, Parts 1-3., pp. 21-31. Modena, 1920.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

Much has been written on the subject of mycorhizae, but as NEGER says, the results obtained are not proportionate to the labour expended. Researches have been chiefly directed to the humicolous *Tuberales*, *Hymeniales*, and *Gasterales*, and to the *Hyphomycetes* and *Mucorineae* of the forest soil, as being the possible source of the ectotrophic mycorhizae.

Many writers have regarded mycorhizae as the mycelium of humicolous *Hymenomycetes*, because a number of *Agaricineae* and *Boletineae* only grow in the neighbourhood of certain forest trees. The researches of MÜLLER and MANGIN have proved that, in the mycelium of some of the ectotrophic mycorhizae of forest trees, there occur the fibuliform connections regarded as peculiar to *Basidiomycetes*.

The author had already stated that many species of cap-fungi are found growing at the foot of trees with ectotrophic mycorhizae, whereas except for a chance group of meadow and dung fungi, they are never seen near trees without mycorhizae, or with endotrophic mycorhizae.

There is, however, but little direct and trustworthy information regarding the genetic relation between humicolous *Hymenomycetes* and ectotrophic mycorhizae.

The distribution of these *Hymenomycetes* in the Vaudois valleys has convinced the author that a large number of these fungi, especially *Agaricineae* and *Boletineae*, are connected with trees.

The dry season had greatly hindered the development of cap-fungi, but the few observations the author was able to make convinced him of the existence of mycorhizal connections between *Larix decidua* and *Boletinus cavipes*, *Boletis elegans*, and *B. laricinus* on the one hand, and between *Populus tremula* and *Boletus rufus* on the other. The best opportunity for the study of these connections occurs when the fungus fructifications grow on the edge of a flat stone, lightly covered with soil. The author cut out a fairly large clod of earth and removed it on a shovel to the laboratory. There he carefully examined the mycorhizae under the microscope, follow-

(1) See also *R.* Sept. 1915. (*Ed.*)

ing the mycelial hyphae from their point of origin to the place where they pass into the stipe of the receptacle, or into the club-shaped fructifications. *Boletinus cavipes* is a very good subject for study, on account of the thickness of its hyphae.

The best places to make observations are the sides of foot-paths, and the borders of streams flowing near larches and aspens. Little can be done where the soil is rich in humus.

The ectotrophic mycorhizae of *Larix decidua* produced by the three above-mentioned *Boletineae* have the same appearance and structure. In direct light, the mycelium is white, whilst the hyphae are hyaline, thin, and septate, as is shown by the microscope, and are very much alike in all three species of fungus.

The author did not find on the roots of *Populus tremula* the distinctly coraliferous ramifications of the mycorhizae that occur on the larch, but the mycelium of *B. rufus* which produces them has the same characters as that of the three species of fungi producing mycorhizae on the larch.

953 – **Certain Relationships Between the Flowers and Fruits of the Lemon.** — Reed H. S. (Professor of Plant Physcology, University of California), in the *Journal of Agricultural Research*, Vol. XVII, No. 4, pp. 153-165, tables 10 + 1 fig. Washington D. C., July 15, 1919.

The author attempts to discuss :— 1) the seasonal distribution of the fruit buds ; 2) the size and productiveness of the inflorescences ; 3) the time required for the growth of fruit and the relation of this time to the season at which the buds appear ; 4) the numerical ratio of flower buds to mature fruit.

A small group of Lisbon lemon trees were selected for study, and these occupied a large industrial orchard and received no special treatment during the 2 years when the observations were being made.

Approximately 66 % of the fruit buds appeared during March and April ; 13 % in November ; 17 % between April and November, and about 3 % during the winter months.

The distribution of buds on an inflorence showed no tendancy to follow the normal curve of errors. Few-flowered inflorescences predominated numerically over many-flowered inflorescences. A bud on a small inflorescence had a greater chance of developing into a mature fruit than one on a large inflorescence. The competition between individual buds on larger inflorescences seemed to be too severe to allow all to survive.

The time required for the fruit to reach maturity varied from 7 to 14 months according to conditions. Fruit which was set in May, June, and July reached maturity soonest. The season at which fruit was set appeared to influence, but not wholly determine the time which was required for maturity.

The records for 4440 buds showed that 51.98 % set fruit, 21.71 % reached a diameter only of $^1/_4$ inch, and 6.62 % reached the stage of maturity.

A fruit set in the spring had the best chance of survival and of re-

aching maturity. The chances of reaching maturity diminished as the season advanced.

954 – **Ripening of Pears and Apples as Modified by Extreme Temperatures.** — OVERHOLSTER, E. L. and TAYLOR, R. H., in *The Botanical Gazette*, Vol. LXIX, No. 4, pp. 272-296 tables 5, bibliogr. of 8 publications. Chicago, April 1920.

This work was undertaken as a result of previous experiments carried out by SHAMEL (1) who believed that it was the high relative humidity which was the controlling factor in retarding the ripening of pears, but the factor of high temperatures was also present. Hence an experiment was outlined by the authors to endeavour to determine whether high temperatures, or humidity, or both, where responsible. Bartlett, and Easter Pears, and Yellow Newton apple were chosen for investigation purposes. Comparative results showed that temperatures between 87.7° F and 110°F caused an appreciable delay in ripening of green first crop Bartlett pears. This was directly proportional to the increased degree of heat within the limits of 87° to 104°F. Second crop pears placed at a temperature of 101° F, and surrounded by a relative humidity of below 50 %, remained unripe 4 weeks after similar pears had become fully ripe at room temperature and humidity The flavour of pears subjected to temperatures higher than 85°F showed slight acidity and lack of juice.

There was a comparatively large loss from rot with fruit kept at high,. temperatures + high relative humidity.

If the pears have nearly reached a stage of complete ripeness, the temperatures above 70°F do not check the ripening process, but the ripening and breakdown are more rapid with each appreciable rise in temperature. Unripe Easter pears behaved in the same way.

Experiments with the apples showed that ripening is not delayed by temperatures above 32°F and then takes place with increased rapidity. This is true with temperatures up to a point which result in the disorganisation of the protoplasmic contents of the cells.

The authors suggest that these results indicate that the pears might be allowed to remain on the trees somewhat longer in an excessively hot season than with a normal season, and that in the case of apples, the necessity of quickly cooling after harvesting is emphasized.

955 – **Chemical Analysis of Carob Bean** — — I CONDIT, I. F., The Carob in California, in *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* No 309, pp. 431-440, figs. 6. Berkeley. 1919. — II. JAFFA, M. E., and ALBRO, F. W., Nutritive Value of the Carob Bean, *Ibid.*, pp. 441-452. figs. 2. bibliogr. of 23 works.

Th Division of Nutrition has completed the analyses of a number of samples of carob beans, from various sources and the results showing the percentage composition of the pods and seeds are presented herewith.

(1) See *R.*, August 1917, No. 771. (*Ed.*)

I. *Pods and Seeds.*

	Water	Ash	Protein	Ether extract	Sugars: Reducing	Sugars: Sucrose	Nitrogen free extract	Crude fibre
	%	%	%	%	%	%	%	%
Minimum	9.12	1.57	3.26	1.06	3.25	6.39	26.09	4.98
Maximum	19.81	3.46	15.22	3.82	18.69	41.56	43.57	17.42
Average	13.28	2.57	6.75	2.17	11.08	19.44	39.80	9.29

II. *Pods.*

Minimum	3.70	1.75	2.82	0.22	3.09	7.02	24.48	3.14
Maximum	24.70	3.87	7.18	4.02	20.54	43.02	48.36	15.31
Average	11.50	2.72	4.50	2.37	11.24	23.17	36.30	8.78

III. *Pods. Calculated to Water Free Basis.*

Minimum	—	1.96	2.27	0.26	3.98	7.82	26.69	3.40
Maximum	—	4.10	7.72	4.51	23.07	47.56	51.30	15.99
Average	—	3.09	5.03	2.62	12.61	26.45	40.56	9.78

IV. *Seeds.*

Minimum	8.89	2.32	14.44	1.83	—	—	55.66	6.90
Maximum	13.63	3.60	19.09	3.66	—	—	62.54	8.34
Average	11.74	3.18	16.46	2.50	—	—	58.61	7.50

The nitrogen free extract and non sucrose content of the pods proves the presence of other carbohydrate compounds than sugar in the carob, but the exact nature of these compounds is as yet unknown, save for the fact that about 1 % of amide has been discovered.

PLANT BREEDING

950 - **Riccio Wheat (Winter Awnless Very Early Variety).** - - STRAMPELLI, N. in *Italia agricola*, Year LVII, No. 7 p. 208 + 1 plate. Piacenza, July 15, 1920

Another excellent, very late type (1) of the hybrid *Wilhemina Tarve* × *Rieti* is No. 76 m. This was also crossed in 1913 with Akagomughi, and among the varieties obtained, was No. 560-1916, which received the name of " Riccio ".

It has the following characters :

Ear red, awned, square, slightly inflated, maximum density 36, average number of fertile spikelets 21, minimum 10, maximum 23.

Spikelets with 4-5 fertile flowers, and 6 in the centre of ear ; average number of caryopses per ear about 70, maximum 85.

Glumes oval-inflated, truncated, keeled, with 3 almost equal ribs brown-red at the edge, short rostrum.

Paleae ovate-lanceolate, surmounted by a rostrum that becomes a small awn (5-10 mm) in the last spikelets near the top of the ear.

Caryopses oval, slightly globular, a little asymmetrical, of a fine wheat yellow ; their size varies with their position in the ear; lobes circular in sec-

(1) See *R.*, July-August, 1920 No. 732. (*Ed.*)

tion, central side convex; average length 5.8 mm.; average breadth 3.5 mm.; dorso-ventral diameter 2-8 mm. ; weight of 1000 caryopses 36.87 gm.

Fracture starchy, glutinous.

Culms, strong, hardly 85-90 cm. in height.

Tillering poor.

Ripening very early : in 1917 harvesting began on June 12, in 1918 on June 14, and in 1919, the wheat was ripe on June 30, whereas " Rieti " was harvested on July 15.

Yield : 31-60 quintals per hectare in 1919

As Ardito and Riccio are very early wheats, catch-crops can be more easily grown with later varieties, but they were specially created for soils inclined to drought, where the grain is subject to scald.

957 – **Natural Wheat-Rye Hybrids in the United States.** — Leighty, C. E., in *The Journal of Heredity*, Vol. XI, No. 3, pp. 129-136, figs. 4 Washington March, 1920.

In 1918 the author discovered 19 natural wheat-rye hybrids on Arlington Experimental Farm, and others at the Virginia Agricultural Experiment Station.

At Arlington, in order to reduce the chances of cross-pollination between the different varieties of rye, in the intervening spaces between the rye plots different varieties of wheat were sown. At the flowering stage the wind carried the pollen from a rye plot like a dust cloud that could be followed by the eye for a considerable distance, and coming into contact with the wheat plots.

It is in this way that quite frequently natural wheat-rye crosses occur in which the rye is invariably the pollen parent.

Characteristics of the hybrids. — The hybrids were always taller than the surrounding wheat plants, but always slightly shorter than the rye. The " height " may be taken then as intermediate.

The spikelets were nearly always from 1 to 3 cm. longer than those of wheat, and the number of rachis nodes was usually from $^1/_5$ to $^1/_2$ greater than in wheat. Here again the hybrids appear to be intermediate.

All rye varieties were awned and so the characters found were what would be expected in F_1 hybrids between wheat and rye.

The peduncle of the rye is usually rough and pubescent or hairy for some distance below its junction with the spike or head. It is also solid for the same distance downwards. Plants with entirely smooth peduncle are occasionally found.

Wheat has on the other hand a smooth, hollow peduncle of a greater diameter than that of the rye.

The hybrids, with the exception of three possessed more or less rough and pubescent peduncles, but less so than is usual with the rye parent. The three exceptions had however smooth peduncles as in wheat. As regards the diameter, this seemed to present intermediate characteristics and as a rule there was strong evidence of both wheat and rye parentage in the peduncles of hybrids. Wheat-rye hybrids are usually sterile.

Amongst the 19 plants found by the author at Arlington, 7 only pro-

duced one or more kernels ; it is inevitable that the plants here described are first generation hybrids (F_1) produced by natural fertilisation of wheat flowers with rye pollen.

Forty seeds were produced by the 19 hybrids plants (about 1 % set seed). Vigorous plants of F_2 are being grown from a portion of this seed.

The natural hybridisation of wheat and rye is now known to have occurred in 5 different localities of the United States: — in Northern and South-western Virginia, in Tennessee, in Georgia, and in Oklahoma.

958 – **Studies in the Heritable Characters of Maize " Brachytic Culms ".** KEMPTON, J. H., in *The Journal of Heredity*, Vol XI, No. 3, pp. 111-115, figs. 3. Washington D. C., March, 1920.

This variation consists of a shortening of the internodes on the main culm and lateral branches without a corresponding reduction in number and size of other organs. It made its appearance in 1917 in the F_2 progeny of the Chinese × Algerian hybrid designated Dh 416. Approximately one quarter of the plants were brachytic, with shortened internodes (5 brachytic and 21 normal). One of the 5 brachytic plants was self-pollinated, and the resulting progeny were all brachytic, whilst the progeny of a normal plant also self-pollinated were all of normal stature.

The following table shows measurements of plants giving an idea of the existing differences between normal and abnormal (brachytic) progenies :—

	Brachytic	Normal
Height of plant in decimetres ,	8.66 ± 0.10	14.40 ± 0.24
Number of leaves above the ear	3.20 ± 0.8	3.37 ± 0.09
Total number of leaves	22.90 ± 0.19	20.80 ± 0.27
Husk leaves	0.06 ± 0.02	0.58 ± 0.13
Number of branches in the tassel	15.30 ± 0.64	25.90 ± 1.01
Length of the upper ear in cm.	14.20 ± 0.27	16.40 ± 0.23
Total ear length in cm.	27.60 ± 0.98	28.10 ± 0.71
Number of rows on upper ear.	16.30 ± 0.26	21.20 ± 0.30
Diameter of culm in 16th inches	20.50 ± 0.35	12.40 ± 0.21
Length of 4th leaf	62.60 ± 6.20	64.40 ± 8.90
Width of 4th leaf	9.20 ± 1.40	12.60 ± 1.50

It will be seen from this table that the brachytic strain exceeds the normal in the diameter of the culm and the total number of nodes, while the size of the leaves is about the same.

The upper ear is somewhat shorter, but the total ear length is approximately the same in the two strains.

Eleven ears from brachytic plants were artificially pollinated and the progenies produced exclusively brachytic plants, their mean height being 8.8 dm. When crossed with plants of normal stature, the F_1 was as tall or taller than the normal parent, and in F_2 both normal and brachytic plants were secured in the familiar 3 : 1 Mendelian proportion.

959 – **On the Genetics of "Rogues" Among Culinary Peas (*Pisum sativum*).** — BATESON, W., and PELLEW, C., in *Proceedings of the Royal Society, Series* B., Vol. 91, No. B. 638, p. 186-195. London, May 12, 1920.

In 1915, the authors described abnormal specimens of *Pisum sativum* distinguished by the following characteristics:—

1) Rogues arise sporadically from self-fertilised seeds of various races of typical high-class peas.

2) These rogues are characterised by pointed leaflets and upward curving pods. The leaves, stipules, leaflets, sepals, petals, and carpels are much more elongated in shape than those of the normal type, and the seeds are on an average slightly smaller. Taken as a whole, as regards habit and appearance generally, such plants contrast greatly with the rest of the plants in the plantations.

3) Rogues self-fertilised produce rogues exclusively.

4) Rogues crossed with normal types give F_1 plants which as seedlings appear normal, but at an early stage change to rogues, producing stipules, leaves, and eventually pods, like those of rogues.

5) The offspring produced by the self-fertilisation of these F_1 plants are exclusively rogues.

In the variety chiefly studied — "Suttons Early Giant", — plants intermediate between types and rogues are not uncommon. In them a change in the foliar parts occurs like that described in the F_1 plants: but the complete transformation from the normal to the rogue may be deferred to a much higher level than at the usual first flowering node point. On such plants the shape of the pods also often changes progressively, lower pods being straighter and upper pods curved like those of rogues.

In recording breeding results, the authors have identified two groups:

1) those in which none of the leaflets have points; these give on self-fertilisation what is called A families consisting predominantly of normal plants;

2) those in which pointed leaflets sooner or later appear; in this case self-fertilisation gives B families containing predominantly rogues.

The present study has been devoted chiefly to genetic peculiarities connected with the gradual and regular assumption of the rogue characters by the intermediate plants which sooner or later acquire pointed leaflets.

Having established the fact that in the B families, the non-pointed plants come chiefly from the bottom pods, the following experiments were made:

1) Choosing a number of intermediate plants, thought likely to throw B families, each flower was emasculated in turn, as far as possible pollinating them from rogue-free types. The seeds from each pod were sown separately.

It was expected to find that the non-pointed types would come almost exclusively from the lowest pods. This expectation, however, was not borne out by the result, for the proportion of non-pointed among the egg-cells did not diminish noticeably up to the tenth flower.

With the same plants, self-fertilised (intermediate types), it was distinctly difficult to obtain a non-pointed plant from flowers higher than the fourth flower.

How can this be explained ?

2) Tests were accordingly instituted, using pollen of the successive flowers of the intermediate plants and trying it on the ovules of types. Here again the seeds from each pod were sown separately. Compared with the preceding case it may be noted that the proportion of non-pointed decreases rapidly from about the third flower.

The results are set out in the adjoining Table where the proportion of gametes possessing the normal type characters varies with the male and female sides.

According to the data, the authors admit that up to about the 10th flowering node, rather more than 50 % carry the type characters, or at least the non-pointed character, above which the proportion declines. Of the pollen in the two lowest flowers, only about 20 % is type-bearing, and the proportion diminishes rapidly in each successive flower above this level.

Ordinal N°. of flowers	Cross-fertilised						Self-fertilised		
	Type father			Type mother					
	Non pointed	Pointed	Ratio	Non pointed	Pointed	Ratio	Non pointed	Pointed	Ratio
1	57	54	1 : 1.09	9	42	1 : 4.6	18	269	1 : 15.0
2	30	42	1.4	17	83	4.9	21	240	11.4
3	65	46	0.7	8	56	7.0	18	231	12.8
4	50	64	1.1	3	30	10.0	15	228	15 2
5	32	46	1.4	7	86	12.3	4	218	54.5
6	26	37	1.4	2	59	29.5	—	144	
7	48	43	0.9	1	23	23.0	1	91	
8	34	41	1.2	6	28	4.6		71	
9	34	46	1.3		8				
10	25	27	1.1						
11	10	31	3.1						
12	15	23	1.5						
13	10	23	2.3						
14	5	27	5.4						
15	2	8							
16	3	3							
17	2	1							
	454	562	1 : 1.2	53	415	1 : 7.8	77	1492	1 : 19.4

960 – **Selection of Sugar Cane, in Mauritius, Java and in Cochin-China.** See No. 983 of this *Review*. (*Ed.*)

961 – **Studies on the Suckering Habit of Reciprocal Tobacco Crosses: — Little Dutch × Cuban.** — Johnson J., in *Genetics*, Vol. IV, No. 4, pp. 307-340, figs. 2, pl. 8. Princeton, New Jersey, July, 1919.

The two varieties Little Dutch and Cuban were employed as a base for a series of reciprocal crosses. The former has leaves relatively narrow and is distinctly errect ; the number of branches ranges from 4 to 6 and these are small in comparison with most varieties of tobacco ; the number of suckers is also very limited ; the mean being 4.55 ± 0.7 with a mean weight of 22.2 ± 1.08 decigrams. The branches are thicker in the Cuban type ; the mean being 18.32 ± 0.16, and weight 49.63 ± 1.14 dgm.

There appears then to to be a difference of about 13.7 suckers in the two types, and 22.43 dgm. weight in favour of the Cuban type.

Inheritance of number of suckers. — The average number of suckers of the two parents for 1917 is 11.4 agreeing very closely with the mean found for the F_1 generation which is 11.28 ± 0.22 in one case, and 11.6 ± 0.24 in the reciprocal. The standard deviation and coefficient of variability show, however, that the F_1 is somewhat more variable than the parents, and F_2 is even more so. The standard deviation for the Little Dutch is only 0.75 ± 0.05 and of Cuban 1.64 + 0.11, while that of the F_1 is 2.26 + 0.15 as compared with 4.07 ± 0.14 for F_2.

The F_3 and succeeding generations show in a more striking manner the marked segregation which has occurred. Families have been produced which range in means from 4.11 ± .09 suckers (42 J11) to a family with a mean of 15.40 ± .33 suckers (42 V). Furthermore the standard deviations show that families like 42 J11 and 42 A11, have deviations of only 0.98 ± .065 and 1.22 ± 0.08 respectively, and other families however, as 42 G 21 and 42 M show a standard deviation of 4.03 ± 0.27 and 4.81 ± 0.23 respectively.

Inheritance of weight of suckers. — According to the results obtained in 1917, the data indicate that the mean weight of the Little Dutch suckers is 9.4 ± 0.62 as compared with 46.4 ± 1.41 for the Cuban.

The mean weight of F_1 and its reciprocal are very close and compare quite favourably with the average of the two parents, showing however, some heterosis ; Little Dutch ♀ × Cuban ♂ 30.5 ± 1.09 and Cuban ♀ × Little Dutch ♂ 30.1 ± 1.25. The F_2 and its reciprocal is on the average midway between the two parents, and in the F_3 and succeeding generations, the segregation in regard to suckering habit is definitely shown.

In F_3, strain 42 A11 possessed a mean weight of 14.3 ± 0.82, and strain 42 G21, a mean of 48.8 ± 1.61.

F_1 is apparently only slightly more variable than the average of the parents, and F_3 shows some increase in variability, but not as much as expected.

Correlation. — The preceding data indicate a marked correlation between the number and weight of suckers per plant.

Table I shows the distribution and correlation of these characters in 374 plants of the F_2 generation of Little Dutch × Cuban (1917).

TABLE I. — *Correlation between number of suckers and weight of suckers in Little Dutch Cuban F_2.*

Weight of suckers (gm.)	Class centres of No. of suckers: 3	6	9	12	15	18	21	Total
50	13	26	16	7	3	—	—	65
150	3	18	31	20	16	7	—	95
250	—	15	16	20	15	10	—	76
350	—	10	11	18	16	12	1	68
450	—	6	6	16	10	6	1	45
550	—	—	1	4	6	1	—	12
650	—	—	1	3	4	2	—	10
750	—	—	—	—	—	1	—	1
850	—	—	1	1	—	—	—	2
Total	16	75	83	89	70	39	2	374

The coefficient of correlation is distinctly high: $.423 \pm .028$.

A considerable number of random observations and some systematically recorded data tend to show that no particular correlation exists between number, size or shape of leaves, and the number or size of suckers in the second generation of a cross between the large and small suckering types. The coefficient obtained, for example, concerning the correlation existing between the number of leaves and the number of suckers per plant being merely $-.012 \pm .05$. It is evident, according to Table II, that no correlation between these two characters can be said to exist.

CONCLUSIONS. — The cross between Little Dutch and Cuban Tobacco offers a striking example of combination of parental characteristics and uniformity of type in the F_1 generation, and of segregation in F_2, into a great variety of forms as regards various morphological characters. Furthermore, some of these F_2 types may breed true from the start with respect to certain characters; others, however, become fixed in the 4th or succeeding generations; still others apparently continue in a heterozygous condition until F_6.

TABLE II. — *Correlation between number of leaves and number of suckers per plant of Little Dutch × Cuban F_2.*

	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	*Totals*
11	—	1	—	1	—	—	—	—	—	1	1	—	—	—	—	—	—	4
12	—	—	—	—	—	—	1	1	—	1	—	1	—	—	—	—	—	4
13	—	—	4	—	—	1	—	—	2	4	1	7	1	—	—	1	—	21
14	—	—	—	3	3	3	1	3	2	1	2	4	2	3	3	1	—	31
15	1	—	1	2	3	3	1	1	—	2	—	3	3	2	2	1	—	25
16	—	—	—	3	2	—	1	1	—	5	1	1	—	2	—	3	—	18
17	—	—	1	1	—	3	2	2	3	2	—	—	1	2	—	2	—	19
18	1	1	1	—	—	—	—	2	1	2	—	1	1	—	—	1	—	11
18	—	—	—	—	3	1	2	—	—	—	—	—	1	—	2	2	2	13
20	—	1	1	—	2	1	1	—	—	—	—	—	2	2	—	—	—	19
	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
Totals . .	2	3	9	19	14	12	9	10	8	18	5	17	11	11	7	11	2	159

Amongst ratios in these various forms and characters, nothing satisfactory has yet been obtained which could in any way be made to conform to typical Mendelian ratios. This does not however prove that the characters are not conforming to Mendelian principles. The assumption of multiple factors and continuous variation as propounded by NILSSOHN-EHLE (1908-1909) and EAST (1910) can be made to explain the facts as they occur.

From the available data, little can yet be ascertained by entering into a discussion as to the number of probable genes involved ; there are undoubtely a large number of factors concerned.

962 - **Selection of Hevea at the Agricultural Experiment Station of Bencat, Cochin-China.** — See No. 978 of this *Review*. (*Ed.*)

963 - **Apple Tree Crossing (*Malus*).** — See No. 988 of this *Review*. (*Ed.*)

964 - **Bud Variations of Grape Fruit.** — SHAMEL, A. D., in *The Journal of Heredity*, Vol. XI. No. 4, pp. 157-159, figs. 4 Washington, D. C., April, 1920.

Description of a bud variation of grapefruit studied by the author since 1919 discovered, in an orchard containing the "Marsh" variety. Apart from the pink flesh colour of the skin and rind, the fruit appeared identical in size and shape to the normal fruits. Buds have been taken for propagation purposes from this branch, but no trees grown from such buds, have yet fructified. The case is an interesting one for the purpose of completing the existing evidence as to the origin of other varieties of the citrus bearing pink-flesh, red, ruby etc. coloured fruit different from that of established varieties bearing fruit possessing the normal colour.

CEREALS AND PULSE CROPS

965 - **Indo-Chinese Rices: — Selection, Cultivation and Hulling of Rice in Indo-China.** — I. CAPUS (President of the Rice Section of the 1918 Congress of Colonial Agriculture), in *Annales de Géographie*, Vol. XXVII, No. 145, pp. 26-42. Paris, January, 15, 1918. — II. CARLE, E. (Inspecteur des Services agricoles attaché au Laboratoire de Génétique de l'Institut Scientifique de l'Indochine), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 8, pp. 245-247. Saïgon, August, 1920.

For a long time, there has been an annual decrease, to the value of some millions of francs, in the amount of rice exported from Indo-China. This is due to the fact that the varieties of rice grown in that country have proved inferior to the best commercial products of Burma, the United States, Italy, Japan, and even the Dutch Indies and British India. Indo-China now ranks second among the rice-exporting countries (1).

(1) According to the *Annuaire International de Statistique agricole*, 1917-1918, of the International Institute of Agriculture, Rome, 1920, the worlds' average annual production of paddy for the 10-year period 1909-1918 (1909-1910 to 1918-1919) was 729 298 470 quintals. Indo-China takes the fifth place among the rice-growing countries (coming after China, British India, Japan, and the Dutch Indies), with 52 224 813 quintals ; the annual average rose to 54 069 649 quintals from 1914 to 1918 (inclusive). It ranks second as a rice exporting country (after British India) with an average annual export of 9 966 269 quintals of hulled rice and of 289 765 quintals of unhulled rice during the period 1909-1918.

With regard to the exportation of Cochin-Chinese rice, M. NGUYÊN-XUAN GIAC, in

The causes of the inferiority of Indo-Chinese rice have been known for some time, but as yet it has been impossible to remedy them, in spite of a series of measures which the author describes.

The initial mistake is made at the actual centres of rice-growing, where varieties differing in shape, volume, weight, consistency, etc., are all commercially shown by the same name, which is that of the district. The mixture of these heterogeneous varieties is afterwards increased and made worse by the means of buying the paddy and transporting it to the collecting works at Cholon. The Chinese are the middlemen between the Annamite rice-grower and the Cholon mills, and as long as their influence on the factories and the trade continues, no improvement by means of seed selection is possible. The conduct of the Chinaman, with the view of supplying his compatriots with food, militates against this selection. There are in the interior of the country, countless agents, who buy rice in small quantities *mix*, it in their junks, and pay the same price for average quality grain. If a rice-grower had selected his seed, the Chinese agent would not pay him sufficient to encourage his efforts, for this rice would only be mixed with other varieties, and sold at the average price. The rice cultivator has therefore no reason to worry about the quality of rice he sells but only its quantity.

At the Cholon rice-factories the grain, when bought, is again *mixed* before being milled.

The author agrees with M. PARIS, the former President of the Cochin-China Chamber of Agriculture, that the only possible way of improving

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his work, *Le Régime économique de la Cochinchine* (Ernest Sagot and Co., 19, Rue Cujas, Paris, 1920) pp. 96, writes as follows :—

Until 1878, the only kinds of rice reserved for exportation were cargo rices, mixtures of broken grains and paddy which formed as much as 50 %.

Exported in this manner, Cochin-Chinese rices underwent a noticeable depreciation on foreign markets, especially those of Japan and the Indies. The Government, in consequence of the energetic campaign initiated by the Saïgon Chamber of Commerce, passed a resolution in 1878 fixing at 15 % the maximum amount of paddy that might be mixed with cargo-rice.

China is the best customer of Cochin-China. Formerly, the Chinese exported from that country an enormous amount of paddy which they themselves hulled. On account of the numerous complaints of French merchants and traders, a first export super-tax of 0.03 cents per 100 kg. was levied in 1882 on paddy and on cargo-rices containing over 38 % of paddy, and in 1896, this was raised to 0.125 piastre per 100 kg. The result of these measures was a considerable decrease in the amount of paddy exported to China ; from 163 000 metric tons in 1895, it fell to 72 000 tons the following year. In 1915, the total export from China was 350 099 tons. After China, France is one of the chief markets for Cochin-Chinese rice. Since 1891, in order to favour the rice of the Colony, foreign paddy, broken rice, and foreign rices has to pay a tax of 5, 6, and 8 francs respectively on their entrance into France. The amount of Cochin-Chinese rices exported into France rose from 8547 metric tons in 1890 to 23 228 tons the following year, and was 212 610 tons in 1915. The total figures for the rice exported to France include very little paddy, or cargo-rice ; out of 212 616 tons in 1915, there were only 32 134 tons of paddy, 1517 tons cargo rice, 91 700 tons of hulled rice, and 87 265 of broken rice, and rice flours. (*Ed.*)

the quality of the exported rice, is by building one or more large European factories, where the grain can be sorted before being sent to Europe Naturally, however, the factory owner will continue to be reluctant to set up a supplementary plant consisting of a series of sorters and sifters for enormous quantities of paddy, so long as, owing to the low price of Cholon rice, it is readily bought for export to China and the countries of the Far East, where most of it is sent.

This price will not induce the creation for Europe of standard varieties, selling less easily on account of their cost. We have here a vicious circle, from which, according to M. PARIS and the author, there is no escape, except by establishing regional rice-factories with French capital, which will work for the Paris market. At the same time, in the rice fields themselves, seed selection must be practised.

It must not be thought that all the Indo-Chinese varieties of rice are universally of inferior quality; some of them are considered equal to the best trade varieties, and in the rice-factories of Havre (France) Tonkin rice may be found that surpasses the best kinds from Java.

The writer concludes that:—

(1) The commercial varieties of Indo-Chinese rice can and ought to be improved by changes to be made in the present system, with a view to *improving cultivation methods*, in order (*a*) to standardise and fix the best known sorts, (*b*) to alter the defective arrangements for selling rice and transporting it from the fields to the store-houses, and (*c*) to complete the factory equipment and thus ensure the sorting of industrial varieties

(2) These improvements are inter-connected, and interdependent; they must be carried out simultaneously.

(3) The profit that rice-cultivators could obtain from these improvements can be gauged by comparing the different prices of the competing varieties. In normal times, the loss on Indo-Chinese rices (paddy, cargo and hulled rice), imported into France alone, is not less than 13 million francs.

The author then considers in detail the improvement by the choice of seed, *individual selection* of the seed, and the manner in which it should be carried out. He then studies the improvement of the crops, systematic rotation, and fertilisers, etc. The Annamite scarcely ever manures his rice, but depends upon the rich alluvium deposited by the irrigation water, and upon the fertilising substances contained in the rain (1).

The author believes that by selection and by improving the cultivation methods, the rice production of Indo-China might be increased at least 20 %. Since Cochin-China alone produces annually more than 2 million metric tons of paddy on 1 ½ million hectares, the annual gain would be 400.000 tons in quantity, and 4 million francs in value. The present production of the whole Indo-Chinese Union, which now amounts to about 5 million metric tons, would be increased by 1 million

(1) See "The Economic Value of Tropical Rains" by the same author summarised in *R.*, May, 1914, No. 408. (*Ed.*)

tons, worth at the normal price of paddy in the field, 10 million francs. This sum can rightly be regarded as lost at present and if it is added to the 13 million francs mentioned above, a total of 23 million francs annually is obtained. These figures show the great importanoe of the question.

II. M. CARLE, like the preceding author, asserts that Cochin-China possesses varieties of rice rivalling in quality the best kinds produced in Burma, Java, and Japan; the latter are, however, always sold on the European markets at a higher price than the so-called "Saïgon rice," which is the term used on those markets for all the Cochin-Chinese rice exported before the war as cargo-rice.

Cochin-China varieties of rice are regarded, as a whole, as of inferior quality, and a large amount of the stock exported is used in the manufacture of alcohol.

The factors to which this depreciation is to be attributed are of various kinds:—

(1) The variation in quality of the same variety from one season to another, due to too little, or too much water.

(2) The small amount of care taken by the natives at harvest-time, which renders it impossible to obtain pure varieties with homogenous grain.

(3) As the stubble is not dug up at once after the harvest, but only when the rains begin, the seeds that have fallen during the harvest germinate, and the seedlings grow up with those of the freshly-sown variety.

(4) Another more serious mixing of the rice takes place when it comes into the hands of the first buyer, who is usually a Chinese.

The author expatiates on this fourth point, which has already been dealt with above. He comes to the same conclusions as M. CAPUS, and mentions M. GRESSIER'S modern French factory which has already obtained excellent results, but its success should be assured by the previous solution of the provisioning question.

M. GRESSIER, who ow s large rice-fields in the Province of Soctrang, first worked for many years at their progressive and systematic management; having greatly improved the cultural conditions, he succeeded in obtaining more regular crops of better qualities of rice. The suppression of the Chinese middle-man ensured the success of his hulling factory. The factory installed in 1912, is working under excellent conditions. It first treated the paddy grown on the several thousand hectares belonging to M. GRESSIER, but gradually its work was extended, thanks to the purchases effected in the surrounding districts, and to the fact that a higher price was paid for good varieties than for inferior types. M. GRESSIER sells selected seed to growers with an undertaking to buy the crop raised from it. His example has excited a certain amount of emulation in native circles.

It is much to be wished that M. GRESSIER'S initiative should be followed in all the western region. As soon as there are some twenty small

factories scattered throughout this district, the paddy trade will no longer be in the hands of Chinese, and it will then be possible to supply the Paris market with the finest types of table rice.

In the meanwhile, the Direction of the Agricultural Services through the medium of the Indo-Chinese Economie Agency at Paris, with which this Service is in constant connection, has already made known some varieties of rice. If they were introduced into France under their true name, they would very soon be classified on the markets, though hitherto, Paris merchants have simply assimilated and mixed them with foreign varieties.

Two or three consignments of rice of the Huêky variety, grown from seed supplied by the Cantho Agricultural Station, and prepared at the Gressier factory, have been most favourably received at Marseilles. These consignments should be repeated on a larger scale, but, unfortunately, on account of the difficulties of transport during the War, this has hitherto been impossible.

The Director of the Indo-Chinese Economic Agency in Paris has set himself the task of making the choice varieties of Cochin-China rice better known, and obtaining a proper price for them.

The French rice factories of Cholon (which have been purchased by Messrs RAUZY and VILLE and their associates), and the GRESSIER factory at Soctrang, are now better provided than in the past with the means of dealing with consignments of pure paddy, and on their side, intend to use every effort to supply the Paris market with a constant sypply of the best rice.

966 – **Darso.** — BEESON, M. A., and DAANE, A. (Department of Agronomy), in *Bulletin* No. 127 *Agricultural Experiment Station, Stillwater Oklahoma*, Sept. 1919.

Darso is a new sorghum developed and named at the Oklahoma Ex-Experiment Station. Owing to the possibility of its becoming a valuable addition to the grain sorghums, because of its earliness, and dwarfness, selection work has been carried on at this Station for high grain yielding quality and improvement of other characteristics.

Darso is of unknown origin but probably a cross between a non-saccharine sorghum and a saccharine sorghum. It is leafy, stocky, red seeded, drought resistant, early maturing, and very uniform in height.

Comparison Tables show that the forage darso, contains a higher percentage of sugars in the juice than the Black hulled White Kafir or feterita, namely, 5.79 % compared with 2.49, and 4.73 % respectively (as sampled) and 17.85 % compared with 7.78 and 8.85 % (moisture free).

A preliminary report of a feeding experiment indicates that darso does not seem to be quite so useful a feed as kafir for hogs. The animal Husbandry Department of the Experiment Station is continuing the investigations.

The six year's average yield (bushels per acre) is shown as follows: Darso 19.4 — Black Hulled White Kafir, 16.4 — Feterita, 13.91 — Dwarf Hegari Kafir 12.7, (4 years average) — Shrock Kafir 12.1 (2 years average

— White Milo, 5.2 (4 years average). These plants took 103 — 115 — 99 — 108 — 116 — 104 days to mature, respectively.

Comparison between compositions of Darso and Kafir.

Variety	Water	Ash	Protein	Fibre	Ether Extract	Fat.
			Stalks (Green)			
Darso	70.99	2.11	1.28	7.29	17.70	0.63
Kafir	71.80	2.82	1.30	7.32	10.08	0.68
			Etain			
Darso	11.75	1.60	10.94	3.44	65.53	3.74
Kafir	10.08	1.56	10.19	2.39	72.66	3.20

Darso is able to withstand relatively long periods of drought better than kafir. The cultural methods are practically the same as for the other grain sorghums but as it matures in about 100 days, it can be planted later than most of the grain sorghums, and still give relatively good yields. The grain usually keeps better when stored in the head than when threshed Long narrow cribs are to be preferred for this purpose rather than storing threshed grain in bins.

Reports from farmers who have cultivated darso in a limited way during the past few years, indicate that this crop may be of value to the south-west.

967 — **Potato Production** — STEWART. G., in *Utah Agricultural Experiment Station, Circular* N°. 40, pp. 1-54. tables 6, figs. 20. Logan, Utah, July 1919. FIBRE CROPS

The author give details of distribution, description of the plant, place in cropping system, general cultivation grading, storage, marketing and utilisation. It is noted that too hot a climate is adverse to successful cultivation and it is therefore confined to the northernmost States of America. A cool moist climate is largely responsible for Europe's high acre yields combined with intensive farming, seed selection, and thorough rotation, and the careful use of fertilisers.

A diagram is given which shows the average acre yield and average farm price of potatoes in the United States 1866 to 1917. The annual production is 350 to 400 million bushels.

It is advised to leave at least five or six years between potato crops on the same land. After alfalfa, after maize planted on alfalfa stubble, after sugar beets, and after beans, are good places to plant potatoes according to the particular districts under inspection by the author. The application of farmyard manure should supplement rotation.

The fact that potatoes thrive best on sandy loam soils is adequately supported by the authors experiences.

968 - **Notes on Manioc in Indo-China.** — I. Balencie, H., Notes on the cultivation of Manioc made at Agricultural Experiment Station at Bêu-cat of the Economic Service of Cochin-Chine, in the *Bulletin économique de l'Indochine*, Yr. XXIII, New Series, No. 141, pp. 272-275. Hanoi-Haïphong, March-April, 1920. — II. Prudhomme, E., Note on the Composition of Six varieties of Cambodian Manioc in the *Bulletin agricole de l'Institut Scientifique de Saïgon*. Vol. II. No. 7, pp. 196-199. Saïgon, July, 1920.

I. — Experimental crops of manioc were grown at the Bêu-cat Agricultural Station, firstly in soil which was light and poor, secondly without manure, after two ploughings and harrowings, then planting in ridges 1.60 metres apart, (1 metre at the base and 30 cm. high) 20 cm. cuttings at the beginning of the rainy season, so that (growth lasting from 18 to 20 months), the crop could be harvested during the dry season. The cuttings were planted, in the centre of the ridges and 1 metre apart. The only work then necessary was earthing up and weeding.

The results obtained are shown in the following table.

Variety	Weight of tubers 1917	Weight of tubers 1918	Starch	
			per cent.	weight
	Kg.	Kg.	Kg.	Kg.
A				
Native variety				
Manioc annamite	—	4 590	20.250	929.475
B				
Varieties from Réunion				
Manioc Bouquet	28 860	23 700	22.540	5 341.980
Camanioc	30 391	25 400	20.000	5 080.000
C				
Javanese varieties				
Aiping Paraguay No. 5	—	12 500	23.000	2 875.000
Aiping maugi	—	33 333	22.000	7 333.260
Buitenzorg A.	14 080	20 000	33.000	6 600.000
Cassave Bégog No. 9	—	13 786	33.000	4 135.800
Cassave Saona No. 10	—	24 333	29.000	7 056.570
Cassave Pedro preto var. Mandioca	—	12 500	25.000	3 150.000
Zaailing	—	27 030	26.000	6 811.560

These results were obtained without the application of fertilisers and it is obvious that the addition of fertilisers would increase the yield.

It was found by analysis that the amount of prussic acid in the tubers of the different varieties tested is not sufficient to be injurious, so that they can be used for human or animal consumption without danger.

II. — Results of the analysis made at the " Jardin Colonial " at Nogent-sur-Marne, France, of 6 varieties of dried manioc seeds sent from Cambodia by M. De Flacourt, Chief of the Agricultural and Commercial Services of Cambodia.

These 6 specimens came from varieties created recently by selection from a seed bed of one of the three local varieties usually cultivated. Of these six types, two, No. 158A and No. 156A, are particularly interesting because of their high nitrogen content and their low fibre content.

M. De Flacourt states that they are very early and give excellent yields.

969 - **Sunflower as Silage.** — See No. 1008 of this *Review*. (*Ed.*)

FORAGE CROPS
MEADOWS
AND PASTURES

970 - ***Pithecolobium Saman*, a Tropical Tree Producing Fruit that Can be Used as Cattle Food in the Dry Season.** — Salomon, X., Vernet, G. and Nguyen-Duc-Long, in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 7, pp. 193-196. Saïgon, July, 1920.

Stock-feeding during the dry season is a most important problem in Indo-China. MM. Vieillard and Tran-Van-Huu have lately published a paper on this subject, in which they have shown how necessary it is to grow specially cultivated crops during the dry season in that country.

The authors have contributed to the solution of the question by studying the fruit of *Pithecolobium Saman* Benth., a leguminous plant belonging to the Sub-Order *Mimoseae*. This tree is especially valuable in Cochin-China, because its fruiting-season begins in December and lasts till the end of March, that is to say, during the very months when there is a scarcity of grass in the Colony.

The fruits are shaped like a large bean, and have an average length of 17 cm. ; they are very dark brown when dry and much resemble those of the carob-tree, though they are narrower. The pods contain 18 seeds forming 19.82 % of the total weight ; the integuments weigh 80.18 %.

The average composition of the entire fruit (integuments and seeds) is as follows :—

Moisture	30.52 %
Nitrogenous matter	13.08 »
Fats	1.45 »
Sugar and Starch	36.14 »
Fibre	15.90 »
Ash	2.66
Undetermined	0.25 »
	100.00 %

The feeding value of the fruit of *P. Saman* is thus high.

The seeds are very hard, but experiment has shown that they are digested, and that those present in the dung had all been disintegrated during their passage through the alimentary canal.

These fruits are readily eaten by herbivorous animals (horses and cattle). No toxic symptoms were ever observed in the case of the ani-

mals in the Saïgon Botanic Garden, even after the ingestion of large rations of the fruits.

P. Saman seems to do well in many soils, and would be of great use to planters as a stock-feed during the dry season. It grows into a large tree; those in the Saïgon Botanic Garden, are 45 years of age, their trunks have an average girth of 2.70 m., at 1 m., from the ground; the average diameter of the crown is 30 m., and the fruit yield is large.

Planted 20 m., apart in all directions (i. e., 25 trees per hectare), these trees could also act as a shade to other crops.

971 – **The Prairies of Madagascar.** — PERRIER DE LA BATHIE, H., in the *Bulletin économique de Madagascar*, Vol. XVII, Nos. 1 and 2 1st and 2nd quarters, 1920, pp. 1-16. Tananarive, 1920.

The prairies of Madagascar are composed of gramineae which have replaced the trees formerly destroyed by brush-fires. In fact, nearly all the forests on the island have thus been destroyed. The natives, in course of time, have destroyed the virgin forest, there they cut and burned clearings and started a temporary cultivation on the ashes; then by repeated brush-fires burning the vegetation, immense spaces have finally been left completely bare, the end of the process being the exposure of the hard rock, laterite in particular, by unimpeded erosion. The prairie has taken the place of trees and shrubs, and each phase in the denudation of the soil corresponds to a particular type of prairie, characterised by special types of grasses. By ancestral custom the natives still continue to burn the prairie stubble when it is dry. This annual custom of burning finally destroyed all annuals or plants having superficial rhizomes, leaving only species that can live under such conditions (i. e., grasses with deep, perennial roots, and hard and tough culms.) In consequence, in the central regions, where the prairies can hardly be utilised for feeding cattle, the grasses constitute but poor pastures on which the cattle often remain thin and sometimes die of starvation.

Cattle breeding, however, is one of the principal resources of Madagascar (1). The prairies cover, in consequence of the aforementioned methods of the natives, $^3/_4$ of the area of the Island. It is then of great interest to study the types of flora on these prairies and to find means of improving them and making them of more use as pasturage. This the author has done, and gives his observations in the present note.

Although the usual plants of the prairies are either cosmopolitan or common to tropical countries and thus not very sensitive to changes of climate or altitude, there are certain differences in the botanical composition of the prairies in different parts of the island, and the species which are common to these parts behave differently according to place and vegetation.

The author has also studied separetely the prairies of the eastern slopes, the central plateau, and the western slopes, and has made a list of the species which constitute, in the fire areas, the prairies of each of

(1) See *B.* Jan. 1919, pp. 1-11. (*Ed.*)

these regions and he has tabulated also those species which are good for fodder, messicoles, ruderals and authochtones, and grow around the prairies, but are prevented by the fires from entering them.

After having studied in detail the three regions of Madagascar, from these points of view, the author draws the following conclusions :—

In all this area, which comprises $^3/_4$ of the whole area of the island, there are only about 20 species. The reason for this is that only those species able to withstand fire have become dominant and can thus be found everywhere in the island where burning is practised.

It is fortunate three of these species make good fodder, viz., " vero " (*Andropogon rufus*) " rambonalika " (*Pennisetum setosum*) and " ahitrombilahy " (*Chrysopogon* sp.), as well as two mediocre species " danga " (*Heteropogon contortus*) and " mafiloha " (*Andropogon intermedius*).

In addition, no species is actually harmful to cattle, but the seeds of the ' danga " and one or two others give rise to a skin disease and loss of wool, and for this reason there is very little sheep breeding.

The great fault of these prairies is that they rarely have the characteristics of meadows, even in the best regions of the island, and they are not able to nourish more than a limited number of cattle. In the west as much as 5 to 6 hectares are necessary per head of cattle.

All the bad parts of the prairie can easily be modified by simply applying manure to the most sterile soils, then ploughing, followed by the sowing of a good type of fodder chosen from those which have been a long time in the island. Afterwards it will only be necessary, in order to maintain these species indefinitely, to cultivate it by the usual methods and stop the practice of burning.

The good forage species which the fires have prevented from spreading over the prairies, abound in the other parts of the island. It will thus be sufficient to choose those which best suit the soils in order to produce this or that kind of fodder and so to create the various kinds of pasturage In this way the pastures would nourish 20 times more cattle than the present prairie.

Apart from the forests destroyed by fire, and those that will be destroyed, if care is not taken, the fires are harmful in many respects. They are ruining the pastures, stopping all shrub and tree plantation and preventing all the moral and social progress which comes from permanent cultivation and the increase in the value of the soil. Nevertheless, it is impossible and even dangerous to try to stop them at present. The suppression of the fires is none the less an aim that should be kept in view. The establishment of native ownership, which is the only way to make the natives take an interest in increasing the value of the soil, the abandonment of extensive methods of cultivation and cattle-breeding and the consequent improvement in methods of cultivation and breeding, will quickly compel them to stop the fires, by leading to a complete utilisation of all prairie products. Besides, an integral part of the progress remaining to be accomplished should be to turn the island into a great and beautiful country of cultivation and cattle-breeding.

FIBRE CROPS 972 - **Cotton Growing in Mesopotamia.** — *Bulletin of the Imperial Institute*, Vol. XVIII, No. 1, pp. 73-82, London, Jan.-March, 1920.

The soil in Mesopotamia is sandy, but fertile. The climate varies from extreme heat (ranging between 78° and 115°F with a mean of about 90°—100°F in July and August to a degree of cold in winter comparatively rare in corresponding latitudes (ranging between 37° and 62° F with a mean of about 47° to 55° F in December and January).

The rainfall is not sufficient for the requirements of agriculture, and irrigation must therefore be practised. The mean annual precipitation amounts to only about 10 inches, but considerable variation occurs from year to year, the rainfall in 1894 for example being as much as 22 inches, whereas in 1901 it was only 1.6 inches. The typical soil of Mesopotamia is a light calcareous loam which contains about the same amount of nitrogen as the average soils of Egypt, and sufficient potash and phosphoric acid to maintain the growth of cotton without the application of manures.

The region between the Tigris and Euphrates is liable to inundation over a wide area covered by the tributaries. From Bagdad to the sea coast, the Tigris has a slope of 1/130 000, and has deposited its coarser mud within the first 150 miles. This has rendered the upper reaches of the river exceptionally fertile. At about 50 miles below Bagdad, the deposits begin to become finer and salted, and this continues to the sea. The latter soils are sometimes too salt for agriculture, and are much inferior to the friable deposits of the north and south of Bagdad, which are eminently adapted for cultivation under irrigation. The salt lands should, however, be easily reclaimable, provided that a sufficient supply of water is available.

Cotton has been grown in Mesopotamia to some extent from very ancient times, and is now cultivated by the Arabs in small quantities along the banks of both the rivers for local use. The plants are usually grown in conjunction with food crops. The native cotton which is apparently derived from *Gossypium herbaceum* is of variable quality, but on the average approaches the "middling" American grade. Attempts have been made from time to time to grow Egyptian varieties, and small quantities of these cottons are now cultivated at Amara, Bassra and other places. On the banks of the Diala, another variety is grown which resembles the Indian types of *G. herbaceum*.

Mesopotamia possesses a soil and climate favourable to the production of large yields of excellent cotton.

The development of the industry is at present restricted, however, by the smallness of the population, and the need for irrigation and drainage. It is also necessary that transport facilities should be improved, agricultural machinery introduced, and instruction given to the natives in the methods of cultivating and harvesting the crop.

In 1917, Captain R. THOMAS was appointed as Cotton Expert for Mesopotamia, and experiments were forthwith conducted at Karradab on the outskirts of Bagdad with divers varieties of cotton; further

experiments are still in progress. The British Cotton Growing Association proposes to establish a number of model plantations as large scale demonstration and seed farms.

It is estimated that there are at present about 300 000 acres on the banks of the Tigris and Euphrates which could be irrigated from the rivers themselves by means of mechanical appliances ; about 80 000 acres are capable of canal irrigation for summer crops on the banks of the Diala river above Bagdad, and about 120 000 acres on the Euphrates commanded by the Hindia barrage. Assuming that cotton will be grown in rotation with other crops, and that it would occupy only one-third of the total area, in any one year, there is a total of 150 000 to 200 000 acres which would be cultivated annually.

973 – ***Malachra capitata* and its Fibre.** — CAYLA, V., in *L'Agronomie Coloniale*, Year V, No. 32, pp. 33-35. Paris, August, 1920.

The author had the opportunity of seeing, in Guiana, some cultural experiments with two species of *Malachra* (fam. *Malvaceae*, tribe *Ureneae*), viz. *M. capitata* L. and *M. radiata*, which grow wild in the Savannahs. They were first tested at the Landbouw proefstation at Paramaribo, but it is only since the end of 1918 that a cultural experiment on several acres has been carried out at the Kleinhorp Station on the banks of the Cottica near its junction with the Commewijne.

Like all the plantations of the low, alluvial land of Dutch Guiana, the cultivated land at Kleinhoop is banked up into polders ; part of it is planted with commercial cacao trees. Although the riverwater is brakish, the polders and their dykes are kept in such good condition that the cultivated soil is entirely free from salt. On this sandy loam soil, M. DROST, the Director of the Cultural section of the Agricultural Services, obtained the first results which, although still incomplete, are now reported by the author.

Of the two species, *M. capitata* is the more important ; it attains the height of from 2.50 to 5 m., while *M. radiata* is not more than 1.5 to 2 m. high. Hence, the fibres of the latter are shorter than those of *M. radiata*.

When these plants are cultivated they are only sown once, as they re-sow themselves afterwards. In order for them to grow well, it is, however, necessary to keep the ground very clean, and to thin out the crop in the third year.

From 5 to 6 months after sowing, *Malachra* is large enough to produce saleable fibre. It is then cut, and 2 crops can be obtained a year.

The plant appears to grow well in any soil, provided it is not too clayey, and that it is free from salt ; but it has to be carefully hoed, without however exposing the base of the stem.

The average fibre yield obtained in the experiments was from 25 to 40 gm. of tow per plant (a maximum of 65 gm. has been obtained). M. DROST does not think that more than 10 to 15 gm. of fibres 2 m. long could be expected from ordinary crops ; he counts on getting 1250 kg., of tow per hectare. The fibre is prepared by merely retting it for 12 hours.

Thanks to the Director of the Nogent-sur-Marne Colonial Garden, a sample of the fibre brought back by the author was examined by M. Dantzer, professor at the Conservatoire des Arts et Métiers.

He found *Malachra* fibre to be very similar to jute, but its tensile strength is only about $^3/_4$ that of the latter, and it is less flexible; the length of the tow is only $^3/_5$ of that of jute. *Malachra* fibre resembles the fibre of Dâ (*Hibiscus cannabinus*) and of Paka (*Urena lobata*); it could be used for the same purposes as jute of inferior quality.

Malachra capitata could be cultivated with advantage in the French Colonies.

974 - ***Carludovica palmata* and the Manufacture of Panama Hats.** — Cayla, V., in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year V, 1920-1921, No. 31, pp. 21-23. Paris, July, 1920.

Carludovica palmata R. and P. (fam. *Cyclanthaceae*, intermediate between the palms and the *Pandaneae*), is a tree of Equatorial America that occurs from the North-West of Brazil to Central America. As is well-known, its leaves, when specially treated, are used for making the so-called "Panama", or "Guayaquil", hats.

Until lately, this industry was entirely confined to Central America, but recently, according to a report by the French Vice-Consul at Port-of-Spain (Trinidad), *C. palmata* has been introduced into the British Lesser Antilles, and British Guiana. The tree is said to grow well in Grenada, and hats are already being made in Jamaica.

C. palmata is also cultivated in the two Dutch Colonies of Curação and Surinam. The production of the latter colony is of little importance, being limited to the Station of Paramaribo, which supplies leaves to a school of girls, who make them into hats. The author has visited the plantations, and gives information as regards the cultivation of the tree and the preparation of the leaves.

Carludovica is grown either from seeds or cuttings; it prefers the soil of ancient forests, requires shade when planted, and is not much affected by the excessive moisture of the soil. The leaves can be used in 5 years if the trees have been grown from seeds, or in 2 if cuttings were planted. In order for the plant to flourish, half the leaves only must be taken each year, which gives a total varying from 14-20. Dr. G. Stahel, of Paramaribo, reckon an average of 14 leaves.

Before the leaf is expanded, it is cut at the base of the petiole; it then has the form of a much elongated spindle. The sheath is cut longitudinally in such a way that the knife slightly pares the hinges of the folds of the palmate lamina, which in the inside is folded in accordion-pleating. In this way, a series of parallel strips 2 to 2 cm. wide, and 55 to 60 cm. long are obtained; these remain attached to the petiole. The strips are subjected to a combing process, that reduces their width to about $^1/_{10}$ of the original width; they are then bleached chemically and finally dried. All this work is done by women and children.

It is calculated that 1000 *Carludovica* trees can be planted on 1 hec-

tare. When adult, they can furnish 7 to 10 leaves annually, so that the return per hectare is very small.

The author thinks that the cultivation of *C. palmata* should be left to private families ; it can only form a subsidiary industry to be undertaken by the owners of small plantations. It is particularly suited to the natives and their families. In this way, however, excellent hats of fine quality could be made in those regions of the French Colonies where *C. palmata* grows.

975 - **Olive Trees and Olive Oil in Tunisie.** — See No. 1029 of this *Review*. (*Ed.*)

976 - **The Future of Rubber Plantations.** — *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VII, No. 7, pp. 251-253. Antwerp, July, 1920.

Rubber plantations, as well as the rubber industry and trade, are at present passing through a crisis which arouses feelings of anxiety and even apprehension in all concerned. However, according to the author, there is no cause for anxiety, for all that is needed is a judicious change in the methods of working the hevea plantations. The owners must acquaint themselves with this change, which is inevitable, but will bring about a new state of affairs more in harmony with present conditions.

The existing crisis is due to the fact that plantations were suddenly made on a large scale, without previous and conclusive experiments, and hence without any systematic method. At the beginning of the plantation period in the Far East, the sole idea of the promotors was to plant with the greatest speed the largest areas possible, without paying sufficient heed to practical, economic questions of which the following are some of the most important :—

(1) Labour available.

(2) Cost of labour, and the hygienic measures to be adopted with regard to the agricultural workers (1).

(3) The character and drainage of the ground, and the choice of suitable soils for plantations.

(4) The upkeep of this land.

(5) How far apart the trees should be planted in order to ensure normal development and encourage growth.

(6) The most economical methods of tapping, so as to obtain the highest yield without injury to the trees.

(7) The coagulation methods most likely to produce rubber of the best quality.

(8) Pruning the trees.

(1) In the same number of the *Bulletin de l'Assoc. des Planteurs de Caoutchouc*, on page 263, the following observation on Malaria in the Straits Settlements is made :— " Active measures are being taken in these Settlements to strengthen the hands of the Medical Officers and to coordinate their efforts in controlling the mosquito. In Negri Sembilan, over 11 790 persons died of malaria in six years, and there are more than 98 000 cases of malaria in the State annually. As it is calculated that each case represents at least five days illness, this disease costs the planters every year 496 165 days of work. It should be noted that the labour question practically resolves itself into a medical one. " (*Ed.*)

(9) The establishment of nurseries, and the choice of the best seed for sowing.

(10) The selection and clearing of the land ; the removal of all old stumps which would afterwards cause much trouble as the centres of fungoid diseases.

Apart from these questions, which are still being studied, no definite data exist as to the rate of growth of the trees. Large areas have been planted without any attention having been paid to these matters, and it is calculated that there are now 2 450 000 acres under hevea in the Far East, the annual yield of rubber amounting to 350 000 tons.

Rubber is the only raw material of which the price has not risen on account of the war, owing to the fact that hevea exploitation has suffered relatively little from the war itself, which can be readily understood, seeing that the countries where it is grown are so far from the war zones. Owing to the freightage crisis, and the impossibility of selling rubber to central Europe or Russia, large stocks accumulated in Asia, and subsequently found their way by degrees to the European markets. In spite of the extraordinary development of the motor car industry in both America and Europe, these stocks decreased but slowly, and there are in London at the present time 20 000 tons of rubber as against 13 000 in 1919. It must not, however, be supposed that the production exceeds the demand. It should be remembered, that only the United States and certain European countries are now making up the arrears of some years. As soon as Central Europe and Russia again begin to buy rubber, not only will equilibrium be quickly established, but it is to be feared that even taking into account wild rubber, the supplies will soon be far below requirements.

Although the great hopes entertained ten years ago of the future of rubber plantations in the East will not be wholly realised, owing to the circumstance that important factors have since revealed themselves which were then not taken into account, there is, however, no reason for pessimism. It is true that the production of the plantations is now decreasing on account of too early and intensive tapping which has exhausted those heveas that are 20 years old, the density of the plantations, and want of care and method. Indeed, the total export of rubber from the Straits Settlements from January until the end of May, 1920, was only 67 772 tons, as against 77 666 for the same period in 1919 ; yet it is clear that the demand will continue to increase (at least 15 to 20 % annually), so that the inevitable high prices will make up for the smaller quantity sold. It is easy to foresee that the price of the raw material will soon begin to soar. If the demand increases, and continues to do so, it is on account of the extraordinary number of purposes to which rubber can be applied (1) and especially of the requirements of mechanical traction.

(1) The progress in technique encourages the industrial use of rubber. We should here mention in this connection, a new process of vulcanising rubber, described in the *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VII, No. 7, p. 263. Antwerp, July, 1920. Hitherto, rubber has been vulcanised by melting it with sulphur at a temperature

It may be roughly estimated, that $^2/_3$ of the rubber produced is absorbed by motor traction. It is calculated that the United States alone turned out 1 600 000 motor-cars and 400 000 motor-lorries in 1920; the number of motor vehicles at present in use in the United States is estimated at 7 000 000, and the annual increase at 1 000 000. In order to equip all the existing vehicles and those in course of construction, the consumption of rubber in the United States will increase 25 % annually.

What technical changes should the owners introduce into their plantation? In principle, all the experts are agreed that it is necessary to give up tapping 4 year-old trees and to wait until the heveas have attained a reasonable girth, in order not to check their growth by a too early removal of their young bark and latex, which at that time contains an insufficient amount of rubber (1).

The trees must not be so thickly planted as to deprive them of the air and sunshine necessary to their growth (2). The injury already done cannot be remedied by late thinning out; further, the useless trees which are subsequently removed have impoverished the soil to the detriment of those remaining (3). As a matter of fact, 1 acre of plantation ought not to contain more than 30 to 35 well-grown trees (4).

During the winter (when the leaves fall), tapping should be entirely suspended to rest the trees, which produce very little latex at this season.

In order to get plantations into good condition that have been badly managed, and where the bark has been destroyed by intensive tapping, the trees should only be tapped every other day (5) and all plants suffer-

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of 138° C., which has prevented the addition of any substances liable to be destroyed by this high temperature. A new process has been invented by PEACHEY, of the Manchester Technical School (England), in which vulcanisation is effected in the cold, by means of sulphuretted hydrogen and sulphur dioxide, which react and produce water and free sulphur. The raw rubber whether solid or in solution, is treated simultaneously by the two gases, and the sulphur liberated by the reaction vulcanises the rubber. If sawdust, scraps of paper, or leather are added, the mixture is vulcanised. This new discovery seems likely to open a new and very large field for the use of rubber. Rubber could be used for making linoleum, wall-hangings, etc., and for various articles of artificial leather, not to mention rubber boots (which could be made seamless, in one piece), and felt. This new process could also be used in the manufacture of pneumatic tyres. (*Ed.*)

(1) M. E. GIRARD considers that tapping should be deferred, if possible, until the heveas are from 7 to 8 years of age, and have attained a minimum circumference of 60 cm. (an average of 70-75 cm. at 1 metre from the ground. See *R.*, Jan., 1920, No. 50. (*Ed.*)

(2) and (3) Since 1913, M. GIRARD has reduced the density of the Susannah plantation to 100 trees per hectare (before that date, there were 200 per hectare), and in 1915 he made new plantations with very large spaces between the trees, i. e., 18 m. in all directions (30 heveas per hectare) with a catch-crop of coffee-plants. See *R.*, Feb., 1919, No. 205, and Jan., 1920, No. 50. (*Ed.*)

(4) See M. CRAMER'S article on experiments in thinning a hevea plantation in Java, in *R.*, June, 1920, No. 644. (*Ed.*)

(5) As regards tapping methods, see M. GIRARD'S article in *R.*, Jan., 1920, No. 50. (*Ed.*)

ing from " brown bast " (1) should be scraped and cleaned ; dense plantations ought to be thinned, old stumps removed, and floods prevented by adequate drainage, for excessive damp encourages the development of moss, fungoid diseases, and various pests.

It is well to consider that the life of well-tended heveas is from 30 to 35 years, and every year new plantations should be made according to the latest approved methods.

977 – **The Growth of *Hevea brasiliensis* in the Philippine Islands.** — YATES, H.S. (Botanical Section of the Biological Laboratory, Bureau of Science, Manila), in *The Philippine Journal of Science*, Vol. XIV, No. 5, pp. 501-503, tables 16. Manila, May 1919.

The author states that it has been demonstrated that rubber will grow and yield satisfactory returns in the Philippine Islands. The results of a number of girth measurements of trees of various sizes are given with data regarding climatic and soil conditions in the southern part of the Philippine Archipelago compared with that recorded in other countries, especially the Orient, where Para rubber is now being successfully cultivated. The suitability of the former region is indicated for *Hevea* culture.

The rate of growth of *Hevea brasiliensis* is also compared between these countries. It certainly finds its optimum habitat in regions at comparatively low elevations, possessing a climate with a rainfall not much below 2000 mm., evenly distributed throughout the year, and with a temperature rarely, if ever, falling much below 19 or 20°C, at least for any extended period. The humidity should also be fairly high.

It is probable that the retardive effect of altitude upon rubber is related to the lower temperatures prevailing at higher elevations. According to the Table giving the results of an Experiment in Malaya to show the effect of altitude upon the growth of *Hevea*, a considerable reduction in the rate of growth as elevation is increased, should be noted. Generally speaking Para rubber may be said to do well on any soil that will support a heavy forest growth, provided drainage is good, but heavy clay soil is not so suitable as loam or sand.

Measurements of trees at present growing in the Philippines show a rate of growth comparing favourably with records in Ceylon and Malaya. The average yearly increment of all trees measured appears to be about 2.4 inches.

The yield obtained from trees now being tapped is very satisfactory and compares well with the above mentioned countries.

978 – **Experiments on *Hevea brasiliensis* on Grey Soil (2) in Cochin-China.** — DEVRAIGNE, G. (Chief of the Economic Service of Cochin-China), in *Bulletin economique de l'Indochine*, New Series, Year XXIII, No. 142, pp. 275-405 plan, 1 + diagr., tables 3, numerous figures, graphs, and photos. Hanoï-Haïphong, May-June, 1920.

The results of experiments extending over the 3 years, 1917-1919, at the Bêncat Agricultural Experiment Station, Cochin-China.

(1) " Brown bast " is a very common hevea disease in all the hevea plantations of the Far-East. Experts are not agreed as to the causes of the malady, as they have not yet been thoroughly determined. (*Ed.*)

(2) For the nature and distribution of the " red soils " and " grey soils " of Indo-China See *R.*, Feb., 1919, No. 205. (*Ed.*)

The following is the analysis of an average soil sample taken from the diagonals of the 16 hectares under heveas at the Station :—

Composition per 1000 *parts of crude soil dried at* 100°C.

Physical analysis		Observations
Coarse sand per 1000 parts of dry soil	38.79	—
Fine sand	774.89	Sandy soil poor in fertilising substances
Organic remains	7.89	
Clay	172.50	
Humus	traces	
Undetermined	5.92	
	1 000.00	
Chemical analysis :		
Nitrogen per 1 000 parts dry soil	0.029	
Phosphoric acid as $P^2 O^5$	0.081	
Potassium as K^2O	0.136	
Lime as CaO	traces	
Magnesia as MgO	0.200	

The experiments are to be continued for several years in order to know whether the differences now observed will continue. Until this is decided, it is impossible to arrive at any exact conclusions, but, for the moment, the author simply gives the results obtained.

Spacing. — Two lots of hevea, A and B :— lot A contains only trees planted 6 m. × 6 m., and lot B trees planted more closely at 4.50 × 4.50 m. In close spacing, the yield per tree is less than where the trees are farther apart, but the total quantity of rubber per hectare is greater (1).

The extra yields obtained by planting closely were :—

in 1917	138.192 kg.	more per hectare
» 1918	296.278 kg.	» » »
» 1919	206.949 kg.	» » »

Tapping methods. — Comparative experiments with the various systems of tapping usually employed in the case of trees of the same age in widely-spaced, and closely-spaced plantations.

The following tapping methods have been tried :—

(1) The ¼ spiral, ½ spiral, half-herring bone over ½ the circumference in the case of trees planted in 1907 ; (1) ⅕ spiral, with 2 notches one above the other, ⅕ spiral with 1 cut, half herring-bone-cut over half the circumference of the trees planted in 1910. It was found that the longest cuts produced the most latex, while in the case of incisions

(1) The author points out that definite conclusions should not be drawn from these results obtained in 3 years; further, the question of the future of the plantation must be taken into consideration, as well as the yield at any given time ; see, as regards spacing of heveas, *R.*, Feb., 1919, No. 205, and *R.*, June, 1920, No. 644. (*Ed.*)

of equal length, the half herring-bone-cut over ½ the spiral gave the best results.

Inclination of incisions. — The experiments were made on trees planted in 1900 in avenues 6 m. apart, those on one side being tapped from right to left, the others from left to right. The direction of the incisions was altered twice, and it was always found that the best results as regards yield were obtained with incisions from left to right.

Alternation of tapping. — Experiments made on trees planted in 1912, and tapped for the first time in 1920. The best results have hitherto been obtained (both as regards yield per tree and per hectare) by tapping every day. A decrease of 50 % in the yield of dry rubber occurred in the series of trees tapped alternately.

In the case of daily tapping, the bark destroyed amounts to 40 cm. per annum ; with alternate tapping, only 20 cm. should theoretically be destroyed, as the tree is tapped half as many times. As a matter of fact, however, 30 cm. is destroyed, owing to the greater desiccation of the surface of the incision, which obliges the tapper to remove a thicker layer (1).

The author has drawn up a complementary programme for the study of alternation which was to be put into execution n 1920 in the plantation belonging to the Ongiem Prison (Maison Correctionelle), adjoining the Agricultural Station. He intends to publish the results obtained at the end of each year.

Tapping rotations. — The tapping methods now on trial at Bêncat are the following :—

(1) $^1/_5$ spiral with one cut (complete rotation in 10 years with $^1/_5$ of the circumference in 2 years, or in 5 years with $^1/_5$ of the circumference of the tree every year) ;

(2) $^1/_5$ spiral with 2 superimposed cuts (rotation in 5 years with $^1/_5$ of the circumference every year) ;

(3) ¼ spiral with 1 cut (rotation in 8 years, with ¼ of the circumference of the tree every year) ;

(4) ½ spiral with 1 cut (rotation in 6 years, with ½ the circumference of the tree in 3 years) ;

(5) Half herring-bone incision on half the tree (rotation in 6 years with ½ circumference of tree in 3 years).

The coolies should never destroy more than 40 cm., of bark per cut per year ; good tappers, tapping every day, only remove from 30 to 35 cm., annually.

(1) The same observation as that made in the previous note : M. E. Girard and many other experts advise wide-spacing, later working, and the substitution of moderate and alternate tappings for intensive methods. This advice takes into account the future success of the plantation, the time for which it can be worked, and the total rubber yield throughout a long series of years. See especially, *R.*, Feb., 1919, No. 205, and *R.*, Jan., 1920, No. 50. (*Ed.*)

The appearance and growth of the trees. — So far, the different tapping methods tested at the Station have not exhausted the trees, and their yield in dry rubber increases every year.

in 1917 the average yield per tree was	0.058 kg.
» 1918 » » » » »	1.634 »
» 1919 » » » » »	2.376 »

Trees with heavy yield. — As some trees planted in 1900 were remarkable for the very large amount of rubber they produced, they were each numbered, their rubber collected, prepared, and weighed separately, in order to study the regularity and continuity of these exceptional yields. The seeds of these trees are carefully collected, and sown in a separate nursery. The following Table gives the production in 1918.

Exceptionally High Yields of Certain Heveas.

No. of trees	*Year 1918* — 344 days tapping at 40 cm. above the ground — Weight of rubber obtained in kg.	*Year 1919* — The field has slightly decreased owing to the tapping being done at 80 cm. above the ground — Weight of rubber obtained in kg.
103	8.403 (latex rubber)	3,633 (latex rubber)
119	7.122 » »	3,288 » »
123	12.214 » »	9,192 » »
138	10.075 » »	11,919 » »
147	12.690 » »	5,376 » »
173	8.279 » »	5,237 » »
176	7.777 » »	9,160 » »
185	9.137 » »	8,865 » »
188	6.926 » »	6,789 » »
195	6.907 » »	4,465 » »
Total	90.520 » »	67,944 » »
	If to this total is added the amount represented by the secondary rubber 12.573 kg., it will the seen that these heveas have yielded on an average 10 kg., per tree, or about 30 gm., per day of tapping.	If to this total is added the amount represented by the secondary rubber 12.410 kg., it with be seen that the heveas have produced on an average 8.055 kg., per tree, or about 25 gm., per day of tapping.

The author subsequently describes the collection and preparation of the latex at the Bêncat Station.

The Quality of the Bêncat Station Rubber. — Tests applied to this product have shown it to be of excellent quality.

979 – **Some Preliminary Experiments on Alternate Tapping of Heveas in Cochin-China.** — VERNET, G., in the *Bulletin de l'Institut Scientifique de Saïgon*, Year II, No. 8, pp. 227-236. Saïgon, Aug., 1920.

The author has started work on the " grey earths " (1) following on the studies of M. GIRARD (*Note sur la culture de l'hévéa en Cochinchine*) (2), which dealt with red earths.

The author used trees in the plantation of MM. GUERY and PÂRIS at Tân-thanh-Dông.

M. GUERY experimented on the tapping of sectors of varying importance where exploitation had begun at various intervals of time. The author found in December, 1919, that it was not wise suddenly to change the sectors tapped as the trees had been worked for several years and the tappings had reached the basal portion of the tree ; tapping thus should not be deferred until the moment when yield is small. Moreover, by alternate tapping during the dry season the bark remaining on the low part of the trunk, the best results are obtained. In fact, this enables the trees to be prepared for alternate tapping, and makes it possible to see the influence of interrupting tapping on sectors of equal importance.

The general plan followed was :—

(*A*) In December, 1919, a comparative study of the growth and yield of the trees under unchanged conditions.

(*B*) From January to April, 1920, a study of the influence of alternate tapping on trees in sections worked in a similar way.

(*C*) From April onwards a study of the influence of alternate following tapping on sectors of varying importance.

During these experiments comparison was always made with trees tapped daily, with incisions covering ¼ of the circumference.

The author gives the results of the two first periods of the series of investigations.

A) STUDY OF THE GROWTH AND YIELD OF THE TREES INTENDED FOR THE EXPERIMENTS. — The author made use of strips in his studies and doubles his experiments so as to permit of establishing comparable averages.

Rows 1-6, used as controls, gave at the end of December an average daily yield per tree of 3.84 gm. of dry rubber. The heveas were from 40.9 cm. to 1.5 m., in girth just above the ground.

Rows 2 and 5 tapped every day in December, but destined for alternate tapping (1 month in 2) gave 3.88 gm., per day per tree in December, the average girth being from 42 cm., to 1.5 m.

Rows 3 and 4, tapped each day in December, but destined to be tapped 1 month in 3, yielded 3.62 gm. per tree per day. Girth 41.2 cm., to 1.5 m. When the experiments were begin the average yield was from 3.62 to 3.88 gm., per tree per day, and the average increase in girth was from 40.9 to 42 cm., which was sufficiently close to permit of a comparative study.

(1) For information on the red and grey earths of Cochin-China see *R.*, Feb., 1920, No. 205. (*Ed.*).

(2) See *R.*, Feb., 1919, No. 205, and *R.*, Jan. 1920, No. 50. (*Ed.*).

(*B*) Influence of alternate tapping on the yield of sections of similar importance. — The following table gives the influence of alternation on the rubber yield per day of tapping as compared with controls tapped continuously :—

	Yield per tree per day. Average of 2 rows.		
	Controls	Tapping 1 month in 2	Tapping 1 month in 3
January 1920	4.02 gm.	not tapped	not tapped
February »	3.27 »	4.31 gm.	» »
March »	3.48 »	not tapped	4.89 gm.
April »	2.93 »	4.39 gm.	—

Tapping 1 month in 2 gave in February, 1920, an increase of 1.049 gm., or 31.8 % over the controls, and in April, 1.460 gm., or 49.8 % more

Tapping 1 month in 3 gave in March, 1920, 1.41 gm., or 40.5 % increase, a still higher gain.

Influence of alternation on total yield. — From January 1 to April 30, 1920, the control row of 283 heveas gave 119.483 kg., of dry rubber, or an average of 0.422 kg., per tree.

The two rows tapped 1 month in 2 gave, in the same time, 72.523 kg., for 281 heveas, or 0.258 kg., per tree, a loss of 46.084 kg., for the 281 trees.

From January to March, the control trees yielded 93.388 kg., an average of 0.329 per tree, and those tapped 1 month in 3 gave 41.044 kg., or 0.151 kg., per tree. The difference per tree is 0.178 kg., and tapping 1 month in 3 has left in the bark, compared with the controls, 48.238 kg., for 271 trees.

This loss of latex is compensated to a certain extent by the following factors :—

(*a*) An increase in the power of production.

(*b*) A strip of bark 1 cm., wide (corresponding to 2 month's rest) is left at the base of heveas, tapped alternately, and the most productive zone of the bark is still workable.

These results cannot be used for judging the value of the method proposed by M. Girard. From figures given in tabular form by the author, other facts can be deduced. The time necessary for the trees to return to their normal yield after a long interruption has been much disputed. However, the author's figures show that, on the average the test trees equalled and even exceeded the yield of the controls in 4-5 days after tapping was recommenced.

The maximum daily yields of rubber of trees tapped 1 month in 2 are given on the 8th, 9th, 14th, and 17th days ; for tapping 1 month in 3 the 10th and 12th days after the recommencement these maxima are obtained.

980 – **Alternate Tapping** (1). – *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VII, No. 8, pp. 285. Antwerp, August, 1920.

A circular published by the Rubber Growers' Association and dealing with two most important questions, the scarcity of labour in the plantations of the Far East, and the alternate tapping of heveas.

The labour crisis is serious in all the rubber-producing regions of Malaya, and throughout the East, with the exception of Ceylon ; it is rendered more acute by the dearth of food materials, for the different Governments insist upon the production of these, which still further reduces the number of labourers required for the hevea plantations. The demand for coolies exceeds the supply, and wages are rising in an alarming manner.

Giving the existing state of affairs, no opposition can be aroused by the suggestion of tapping the trees only every two days, but this method is further justified by the fact that there is not too much healthy bark on the accessible parts af the trees in the plantations. In Ceylon, on the other hand, where the condition of the bark is better than elsewhere, alternate tapping is practised on most of the estates.

If the bark is used up more rapidly than it can be replaced by nature, the plantations are living on their capital.

A certain number of trees have disappeared and some of the bark that had been spared has already been lost, owing to various diseases of which the most important is " brown bast ". The exact cause of this malady is unknown, and no control measures have yet been devised. Trees tapped every two days would be less exposed to " brown bast ", than those tapped every day ; this is a fact which should be taken into consideration.

The Council of the Rubber Grower's Association, after carefully considering the matter, advise all companies and owners of hevea plantations to consider whether it would not be possible to remedy the scarcity of labour by reducing the destruction of the bark either by tapping every two days (without lengthening the cut), or by giving complete rest to sections of the plantations where the bark-reserves are perceptibly diminishing.

As regards the price of rubber, if a smaller amount arrived on the market, prices would be bound to rise.

981 – **" Change-over Tapping „ Method Adopted for Rubber in Ceylon.** — Petch, T., in *Department of Agriculture, Ceylon, Bulletin No.* 47. Colombo, March, 1920.

In " change over " systems, tapping is periodically transferred from one side of the tree to the other, resting each side at intervals. This system began to be adopted in Ceylon in 1913. Tapping was made on the half and quarter method.

(1) For methods of tapping; relation between the production of rubber and the destruction of the bark ; influence of tapping in the duration of hevea trees ; choice of tapping methods, see *R.*, Jan., 1920, No. 50. (*Ed.*)

The following results relate to the comparative experiment conducted at the Experiment Station, Peradeniya from 1914 to 1918 relative to the change-over tapping at an interval of 3 months on alternate days on the quarter and on the half (the control experiments made it possible to ascertain the effect thereby obtained compared with tapping continuously).

1) A slightly increased yield was obtained by change-over tapping when tapping on quarters, but no increase when tapping on halves.

2) Six months after tapping, bark renewal was better in change-over than in continuous tapping on quarters, but there was no difference in the case of tapping on halves.

3) The weight of rubber obtained from a given volume of latex is, on the average, the same, whether the tapping is continuous or change-over.

982 – **The Camphor Tree in Algeria and on the Mediterranean Coast.** — TRABUT, in *Revue Horticole de l'Algérie*, Year XXIV, Nos. 3, 4, 5, pp. 61-63. Algiers, March-April-May, 1920.

Since 1892, the author has been making great efforts to plant camphor trees in Algeria, with a view to extracting camphor, not from the wood, but from the leaves. He has introduced camphor trees from Formosa (Japan) which are flourishing, and whose leaves contain an average of 1.5 % of camphor during winter.

Certain persons who deny the truth of the author's statements have-however, prevented him from succeeding in getting large camphor plantations established to take the place of those of cork-oak in the very damp localities on the coast of East Algeria, where the cork, owing to the climate, is " fat " and of no commercial value.

There is now no doubt as to the camphor content of the trees grown in Algeria and on the Côte d'Azur. In 1919, several hectares of the Doumia Forest were planted with camphor trees from the Algiers Experiment Garden, by the Forestry service, with the cooperation of the " Comité des Matiéres premiéres".

The tree grows quite well on the forest soils of the coast, and very fine specimens are to be seen in many places, such as Algiers, Blida, Bougie, El-Milia and El-Hanser.

The author estimates that a plantation 25 years old would easily yield 30 tons of twigs per hectare. As the analyses always show over 1 % of camphor, even taking this minimum, 300 kg., of camphor would be obtained per hectare, and nearly the same amount of camphor oil. The return per hectare. would therefore be very large, seeing the high prices camphor now fetches, and probably will continue to command for some years to come (1).

It is therefore well worth while to develop the cultivation of camphor trees in Algeria and along the entire Mediterranean coast, all the more so

(1) See for the increase in the price of camphor, M. CAYLA's article on *L'état actuel de la production du camphre, essais de culture du camphrier* (" The present condition of the production of camphor, experiments in cultivating the camphor tree "), *R.*, May 1920, No. 528. (*Ed.*)

since the Japanese industry continues to absorb increasingly large quantities of the camphor produced in Japan, and artificial camphor, which is also used by the trade, will continue to fetch a high price, since more than 2 litres of spirits of turpentine are needed to make 1 kg., of artificial camphor, and the preparation of the latter is a very troublesome operation.

SUGAR CROP

983 - **The Improvement of the Sugar-Cane.** — I. BONAME (former Director of the Mauritius Agricultural Station), Methods of obtaining new varieties of Cugar-Cane, an article published by M. G. WÉRY in his work entitled " L'Organisation scientifique de l'agriculture aux colonies ", in *Annales de l'Institut National Agronomique* (*Ecole supérieure de l'Agriculture*) Series 2, Vol. XIV, pp. 75-84. Paris, 1919. — II. WÉRY, G. (from an article communicated by M. VIEILLARD, Directeur du Laboratoire de Génétique de l'Institut Scientifique de l'Indochine) *Ibid.*, pp. 78-71. — III. EKELENS, F. A., Improvement of the Sugar-Cane in Java and Cochin-China, in *Bulletin agricole de l'Institut Scientifique de Saigon*, Year II No. 6, pp. 167-180. Saigon, June, 1920.

I. *Methods of obtaining new varieties of sugar-cane.* — It has been found in all the colonies that the old varieties of sugar-cane, after having yielded a longer or shorter series of large, profitable crops, become gradually less productive, until in spite of every effort and the use of suitable fertilisers, the yield hardly covers the cultural expenses.

Whether this is due to actual degeneration, or to decreased vitality which renders the plant more susceptible to the attacks of various diseases that increase in virulence, the fact remains, and one of the chief aims of the planter is to obtain new varieties to replace the sugar-canes he sees gradually perishing.

Formerly, only one variety of sugar-cane was grown in the principal sugar-producing colonies (the white Otaïti or Bourbon variety). Its yield, however, became so irregular, that others were introduced, which frequently have given rise to periods of prosperity for the sugar industry. This fortunate turn of affairs was often only temporary, for the new canes introduced proved exacting as regards the soil, and degenerated in their turn, sometimes very rapidly.

A. *Seed-bed canes and selection.* — When SOLTWEDET, in Java in 1887 demonstrated the possibility of obtaining new varieties of sugar-cane from seed, this problem was considered solved, and it was supposed that it was only necessary to sow cane seeds in order to obtain an inexhaustible supply of good varieties that could be used as occasion arose. Though the first results have not entirely confirmed this belief, they have nevertheless proved that it is possible thus to raise new varieties, some of which hove already been substituted with advantage for the old kinds hitherto cultivated.

Sugar-canes obtained from direct sowing are always different from the parent plants, and are usually inferior to them. Variation, however, occurs, and this is reckoned as a means of procuring occasionally a variety possessing the cultural and industrial qualities required in sugar-cane grown on a large scale. From the beginning, many thousands of

plants have been procured, but those remaining after strict selection are but few in number.

The flowers of the sugar-cane do not all produce fertile seeds, the fertility of which depends on the variety and the season, whereas varieties obtained from direct sowing show an increasing tendency to bear good seed.

The author gives a detailed description of the method of collecting and sowing the seed, the cultivation and care of the young plants, and the selection of the sugar-cane.

As only a very small number of high quality plants are obtained by direct sowing, it was thought that hybridisation, or rather the crossing of different varieties, would give better results. The probabilities of self-fertilisation, or of crossing, vary to a certain extent according to the method adopted for the pollination of the seeds.

Self-fertilisation can always be ensured by covering the panicle before it is ripe with a muslin bag. Crossing can be carried out under the same conditions by opening the bag and shaking foreign pollen over the pistils when they are fully developed. It can also be secured in the field by mixing varieties that flower at the same time, or by planting (as is done in Java) alternate rows of different varieties of sugar-cane that flower at the same date. In both these last cases, no muslin bags are required.

It would be very useful to be able to detect the dominant character of the male or female plant of a known variety, and to transmit it by means of artificial pollination. If, however, it were possible to discover the dominant character, its transmission would remain most problematical, for the characters of varieties of sugar-cane are not transmitted to the seed by direct descent. No definite results in this direction have been attained in the crossing experiments.

In Barbadoes, in 1904, however, LEWTON BRAIN suceeded for the first time in effecting certain cross-fertilisation. This was done by dissecting the flower under a lens, removing the stamens before they reached maturity, and dusting the stigmas at the right moment with foreign pollen. This is an exceedingly delicate operation in the case of the sugar-cane for the reasons set forth by the author. It thus appears that practically the best means of obtaining sugar-canes from seed is by the usual methods requiring no special technique, and giving large number of plants that can be systematically selected. The quantity of plants thus obtained compensates for the possibly low percentage of individuals of superior quality.

The directly-sown canes are distinguished by a number preceded by the initial of the country from which they came : L for Louisiana, J. for Java, M. for Mauritius, H for Haurïu, D for Demerara, T for Trinidad, B for Barbadoes, etc.

It should be observed that a cane which is very ordinary in its own country, may develop new qualities when imported, but that the reverse has also occurred. Hence, while it is necessary to try and get the best

varieties, new kinds of sugar-cane must always be experimentally cultivated, before being distributed and grown on a large scale.

In short, the results of the experiments are important, and have been confirmed by the success of crops of sugar-canes that have grown from seed, and have largely taken the place of the old varieties in some colonies.

Compared with the latter, they have a more marked tendency to flower and set fertile seed, which is an advantage as far as sowing is concerned but not from the cultural point of view. Further, there is sometimes a difficulty in finding a sufficient number of shoots or tops; flowering arrests the growth of the stem; and the new varieties are often more susceptible to the climate, etc. Cultural experiments should be carried out in all plantations of fair size, in order to obtain good new varieties that can replace the old ones as soon as they begin to deteriorate.

B. *Mutations.* — Sometimes one stem in a tuft of sugar-canes is found to be different from the others. This shoot variation or mutation is generally quite easily reproduced by taking a cutting. A wise choice of shoots, as well as selection, will often make it possible to take advantage of a mutation.

C. *Selection with a view to increasing sugar content.* — The author quotes the experiments made in Barbadoes, Java, and Mauritius, and describes the technique employed. These experiments did not, however, give any very important results.

II. Pasoeroean Station for Sugar-Cane Cultivation. — This is certainly the most complete scientific Institution in the world for the study of the sugar-cane or perhaps of any other crop. It has published several important books and pamphlets the last of which consists of 6 octavo volumes forming an Encyclopaedia of the Javanese sugar-cane.

The Station, founded in 1887, is wholly independent of the Government. Like the Pakalonga Machinery and Technology Stations, it belongs to the Sugar-Cane Planters' Syndicate, which represents 157 plantations of an average of 1000 *bouw* (709 hectares, 1 *bouw* = 0.7096 hectares). The author describes the administrative and financial organisation of the Station.

In addition to the offices, archives, and libraries, the Station includes:— (1) A laboratory for physical soil-analysis; (2) a laboratory for chemical soil-analysis; (3) a botanical laboratory; (4) a lecture theatre for courses of lectures to planters; (5) a laboratory for the study of certain questions relating to sugar-cane cultivation and the industry; (6) a laboratory of sugar-cane bacteriology; (7) a laboratory of soil bacteriology; (8) an entomological laboratory; (9) a laboratory for testing sugar-cane juice; (10) an electrocultural plant (so far no results); (11) a shed where methods of rat destruction are studied; (12) a set of vats for making sugar according to native methods (for using sugar-canes grown at the Station but not reserved for selection).

III. The Improvement of Sugar-Canes in Java (and in Cochin-China. — A. *Java.* — At present there are over 200 varieties at the Pasoeroean Experiment Station.

Many hybrids have been tested, especially those obtained in the first instance from the very strong, wild sugar-canes known in the West Indies under the name of " Glabah " (*Saccharum spontaneum* L.). Of the countless individuals tested, many have been rejected, and there are only a few which can be said to be really of great value. The series of experiments which are always going on, is moreover endless.

Amongst the best and most highly prized varieties, the author mentions the following (according to J. VAN HARREVELD) : E. K. 28 ; 247 B ; D. J. 52 ; 100 POJ ; E. K. 2 ; F 90 ; S W 3 ; Chéribon noir ; Fjep 24. These varieties covered 91 % of the total area under sugar-cane in Java in 1919-1920.

The first hybrid of any value was 100 POJ, which is the result of a cross made in 1893 between the dark-red Borneo sugar-cane and the Luzier variety ; 247 B is a cross Chéribon × Canne morte. Four other hybrids should be mentioned : DI 52 and S W 3. (= Batjan × Chéribon), 36 POJ and 139 POJ (crosses between " Cunnee " from British India and improved varieties).

A graph constructed by M. PH. VAN HARREVELD shows that the sugar production has been more than quintupled in the 77 years from 1840 to 1917, as it has increased from 23 *piculs* to 130 *piculs* per *bouw* (1).

As the varieties are increasing, it is necessary to find characters which allow them to be distinguished from one another as exactly as possible. At present, the following order has been adopted in the description of the varieties :—

1) Stalk : — Colour, shape, wax-coating, hairs.
2) Internodes : — Size, shape, appearance.
3) Nodes : — Shape, " verules ", hairs, number of rows of buds.
4) Leaves and sheath :— Shape, appearance, colour, hairs, etc.
5) Tuft : — Shape and character.
6) Juice :— Composition.
7) Stem :— Number and appearance of shoots.

As soon as new varieties have been obtained, their value must be ascertained by truly comparative methods. The first experiments are undertaken in order to eliminate the unfit, each variety being tested in a separate plot ; then follow the orientation tests. These preliminary trials being completed, the value of the best varieties is tested " by division experiments ". In these, the compartments reserved for the variety A under study alternate with those planted with the variety B, with which it is to be compared : the so-called " touchstone ". In this way a kind of chess-board with alternate squares, usually 24 in number, is obtained :—

A	B	A	B
B	A	B	A
A	B	A	B
B	A	B	A
A	B	A	B
B	A	B	A

(1) 7 *bouw* = 5 hectares ; 1 *picul* = 100 katties = 61.761 kg. = 136 lb. (*Authors' Note*).

As many as 3 varieties, A, B, and C can be compared, but this is the maximum ; then there are 36 divisions for the new varieties and 12 for " the touchstone variety ".

A	B	C	A	B	C
B	C	A	B	C	A
A	B	C	A	B	C
C	A	B	C	A	B
B	C	A	B	C	A
C	A	B	C	A	B

The author describes this method in detail, as well as the system of harvesting and of examining the results. As regards the latter, the probable error must be determined (for all the divisions planted with the same variety at the same time do not give identical results) ; for this, Dr. PH. VAN HARREVELD'S formula is used :— $E = \sqrt{\frac{\text{sum } d^2}{n\,(n-1)}}$, where d is the difference between the production of each division and the average production, and n is the number of divisions used at the same time in each experiment A, B, or C. The results are entered on the following Table : —

Sugar factor . . . . Date of harvest . . . . Experiment Field No. . . .

Yield in cane						Field in sugar that can in extracted first from the juice extraction					
No. of division	Yield		d	d^2	Probable error	No. of divisions	Yield		d	d^2	Probable error
	Per division	Per hectare					Per division	Per hectare			
1						1					
3						3					
5						5					
etc.						etc.					
Total					E =	Total					E =

The data obtained are marked on the map of the experiment field. The cane production is noted in the top left-hand corner of each division, the saccharose content of the juice in the centre, and the sugar yield in the bottom right-hand corner. All divisions of which the cane yield is at least three times greater than the probable error are marked with one red circle, and a second red circle is added if there is the same excess of sugar. Low yields are indicated in the same manner, but the circles are blue, instead of red. As all the divisions included in the same experiment have been coloured, shaded or cross-hatched, in the end a chess-board is obtained showing the relative value of the different lines according to the orientation (east-west, or south north), and the varying richness of the soil. Any comparative difference in yield below 3 times

the probable error is not regarded as of importance ; before arriving at a definite conclusion, it is, however, necessary to refer to the Experiment Garden memorandum-book in which all the data of the experiments will have been carefully entered.

The method described is not only employed in the selection of varieties, but also for resting fertilisers, the effects of irrigation, cultural systems, etc. The author gives instances of its use in the case of fertilisers, and also deals with the methods of soil analysis in Java, giving an instance of its application to Cochin-Chinese soils which he sent to the Pasoeroean Station for analysis.

B. *Cochin-China* (1). — The author sent to Java samples of the varieties of sugar-cane most cultivated in Cochin-China. The information given to him by M. Ph. VAN HARREVELD was as follows :— " Chinese " Cane No. 1 : — Slender Japanese Variety which, on account of its vigour, resists cold climates better than thick varieties ; resembles the Hong-Kong " Tek-cha " cane, which the Pasoeroean Station has already in its collection.

" Yellow cane No. 2 " :— this is the Lahaina variety, largely grown in Hawaii and used in Java in the Panorogo districts under the name of " Mata-été " (2).

" Red Cane No. 3 " : — this is probably the variety known in Tengger as " Teboe Baloeng ". It was gathered in November at Poespo, near Tosari.

" White Cane No. 4 " :— Probably the White Djapara.

" Red Cane No' 4 " : — Closely allied to a variety received at the Station in 1904, and sent from the Ketegan sugar-factory under the wrong name of Ardjoeno ; this cane had the typical double nodes.

Of this collection, Nos. 2, 3, and 4 were sent to the mountains to remove them from any danger of contracting the " sereh " disease.

The author concludes that Cochin-China possesses valuable species of sugar-cane which, however, have to be found, selected, improved, and studied from the cultural point of view, in order to obtain the highest possible sugar yield, from them.

984 - **Sugar Maize.** — See No. 1028 of this *Review*.

985 - **The Cultivation of Different Varieties of Coffee Plant in Tonkin.** — BOREL M., in *Les Cahiers Coloniaux, Institut Colonial de Marseille, " L'expansion coloniale "*, New Series, No. 23, pp. 27-28. Marseilles, August, 1920.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

Contrary to what is maintained by some authors, the author states that coffee-growing is a paying industry in Indo-China, except at an unusual time like the present, when the value of the *piastre* is extremely high. He, however, considers that *Coffea robusta* is not suited to Tonkin. In

(1) For Sugar-growing in Cochin-China, see M. QUESNELS' report to the Colonial Agricultural Congress in Paris, 1918, of which an abstract is given in *R.*, Nov., 1918, No. 1190. (*Ed.*)

(2) A Javanese name denoting that the diseased sugar-cane resembles a plant of citronella or of sweet vernal grass (*Anthoxanthum odoratum*) (*Authors' note*) — See *R.* Oct. 1917, No. 963. (*Ed.*)

fact from its not being able to stand occasional cold winters, it is useless to grow it there, although it may do well in Cochin-China and South Annam. The author has been trying for 12 years to cultivate it in Tonkin but has finally resolved to up-root the 6000 plants he had at Da-Han, although they are in excellent condition, and only to keep a few individuals to serve as a control, like those in his plantation at Bavi.

Coffea liberia, like *Coffea robusta*, is not a variety for Tonkin. While the average yield of *C. arabica* at Da-Han, and Bavi, was 500 gm., per plant, that of *C. robusta* never exceeded 150 gm. At the last picking, 2 kg., were obtained from *C. excelsa* (Chari) ; 900 gm., from *C. arabica*, and 150 gm., from *C. robusta*. All the varieties had, however, received the same care.

It must not be supposed from these figures that *Excelsa* is an ideal variety ; its berries are most susceptible to the cold January fogs, for as they are not ripe before July, they are not fully developed so early in the winter. The 1919 crop was good, thanks to the mild winter, but other years, the yield was only 600 gm., to 1 kg., in the Da-Han plantation, where the plants received the same attention as the *Arabica* variety. It should be mentioned that there are only 500 *Excelsa* plants per hectare, as against 1000 *Arabicas*.

986 – **Cinchona Bark from East Africa and the Cameroons.**– *Bulletin of the Imperial Institute*, Vol. XVIII, No. 1, pp. 22-25. London, Jan.-March, 1920.

In addition to Java, India and Ceylon whence cinchona bark is now chiefly obtained, *Cinchona* trees have been introduced into other parts of the tropics. Samples of bark from the former German Colony in East Africa and from the Cameroons have been received and examined at the Imperial Institute, and these are described in the present article.

Cinchona chips from East Africa. — The manufacturers to whom the first samples of East African bark were submitted for evaluation in 1918 expressed a desire to purchase a shipment of the bark, and in 1919 a consignment was forwarded to the Imperial Institute by the Acting Administrator of the former German East Africa. The consignment consisted of 52 bags of cinchona chips which were apparently derived from *Cinchona succirubra* and 1 bag of quills (net weight 60 lb.), which more resembled the *C. Ledgeriana* type of bark.

A chemical examination of these samples gave the following results : —

	Chips	Quills
	%	%
Moisture	8.8	10.9
Total alkaloids	5.86	4.46
Quinine (1)	1.81	3.39

(1) *Equivalent to crystalline quinine sulphate.*

It will be seen that the yield per cent. of quinine was higher in the sample from *C. Ledgeriana* than in the chips from *C. succirubra*.

In 1918, the samples of chip bark from the latter material yielded 3.39 % of crystalline quinine sulphate compared with 2.45 % from the

present consignment, whilst the yield was comparatively the same for both years from the quills resembling the *C. Ledgeriana* bark.

The results of the investigation confirm the view that cinchona bark of good quality can be grown in East Africa, although the samples of *C. succirubra* have shown variation in the amounts of total alkaloid and quinine present. It would therefore appear desirable to take steps to extend the plantations of cinchona trees, particularly of the *C. Ledgeriana* type, with a view to the production of the bark for British manufactures.

CAMEROONS. — Cinchona has been produced from experimental plantations established by the Germans at Buea in the Cameroons, and 4 samples of bark from these plantations were received from the Government of Nigeria for examination at the Imperial Institute in 1918.

The bark had been stripped from the trees and dried in the sun.

Sample No. 1 was collected from trees growing at an elevation of about 3000 ft.; samples Nos. 2 and 3 were from a plantation about 200 ft. higher up the Cameroon mountain, and No. 4 was from a plantation at a still higher altitude. The 4 samples were similar in appearance, and consisted of quilled pieces of natural bark; the outer surface was in many cases covered with lichen; the inner surface was dark reddish brown and the fracture was light brown.

The barks were analysed at the Imperial Institute with the following results: —

	No. 2	No. 2	No. 3	No. 4
Total alkaloids	7.5	6.3	7.0	8.3
Moisture	9.9	10.2	10.3	10.1

The value of the cinchona barks depends chiefly on the amount of quinine obtainable by the process used by the manufacturer; the samples were submitted to a British firm of manufacturers for further examination, and the following results were obtained :—

	No. 1	No. 2	No. 3	No. 4
	%	%	%	%
Quinine alkaloid	6.14	5.05	5.27	5.28
Cinchonidine	0.55	0.24	0.23	1.17
Yield of crystalline quinine sulphate	8.19	6.73	7.02	7.04

These results show that all samples are of good quality, furnishing from 6.7 to 8.2 % of quinine sulphate.

It appears probable that samples 1,2 and 3 were derived from the *C. Ledgeriana* type, and sample 4 was probably derived from a hybrid.

The results show that these cinchona barks from the Cameroons furnish more quinine sulphate than the average cinchone bark from Java. It is possible, however, that when the trees are regularly stripped, the percentage of quinine may be diminished.

Investigations have proved, nevertheless that only small quantities of cinchona trees exist in the Cameroons, and that all the trees are of the *C. Ledgeriana* variety.

VARIOUS CROPS

987 – **Broom as a Paper-Making Material.** — BLIN, E., in *Journal d'agriculture pratique*, Year, 84, Vol. 33, New Series, No. 8, pp. 150-151, and No. 9, pp. 173-174. Paris, Feb., 1920.

M. ARDOUIN-DUMAZET has recently drawn attention to the possibility of utilising broom (*Sarothamnus scoparius*) as a paper-making material (1). N. ROGER took up this question in 1903, and the investigations made also by the author in 1912, 1913 and 1914, and the communication which he received from Prince BORGHESE with respect to the trials conducted in Italy, have led him to the conclusion that the attention of farmers and manufacturers should be directed towards this use of broom.

The author first deals with methods of cultivation, a matter which should be considered, as the production from wild plants would be insufficient.

As regards sowing, the seed should be collected before it is ripe and left to dry in a well ventilated place. In the spring the seed should be sown very thinly in a field of oats, and in small holes 1 m. apart, putting 2 or 4 seeds in each hole. Later the seedlings are thinned out to 1 plant per hole. In the spring of the third year, the plants are cut back to a height of 30 cm., to encourage sucker growth; the numerous branches which thus develop are cut each year and utilised for industrial purposes.

It is possible to obtain 10 000 plants per hectare in this way and to cut as many as 3 times from the second year onwards with a constant yield for 20 years. According to the data recorded in Italy, the average yield per annum is from 200 to 230 quintals per hectare. It is estimated that 12 000 quintals of green broom yield 6000 quintals after drying, and that this quantity will provide 4200 quintals of paper pulp.

After drying and dressing, the dried broom is passed into a cold, alkaline bath containing either a mixture of sodium carbonate and milk of lime, potash, or some other alkaline substance in suitable proportions to give the same results as the caustic soda. After 3 or 4 days, the disaggregated branches are taken out of the bath, carefully washed and put into another bath containing 1 to 2 % chloride of lime. The stems remain in this bath for 2 or 3 days until they become very soft; they are then taken out and plunged into a cleansing bath containing a small quantity of sulphuric acid or sodium hyposulphite.

After this treatment, the broom is crushed in order to obtain the required fineness of pulp.

The liquid from the baths containing either alkaline soda, potash or other alkalis, retain the chlorophyll, and dissolve the gums and resins, a part of which is saponified and a part set free. By adding fats or oil to this liquid, a good-quality soap may be obtained. In short, the manufacture of paper according to this method includes the following operations: — Cutting; beating; soaking for 6 to 7 days; further grinding; expression in a hydraulic press (to eliminate water, chlorophyll and other by-products); separation and washing in the so-called "hollandaise No. 2" machine; and finally grinding.

(1) *Journal d'Agricultura pratique*, No. 45, Dec. 11 1919.

To treat 16 to 20 quintals of dried broom in one day, and obtain a yield calculated at 12 to 14 quintals of paper pulp, the following plant is necessary :— 2 cutters, 3 cylinder crushers, 2 hydraulic presses, 4 " hollandaise " machines, and 2 grinding machines.

Apart from the residue formed in the alkaline liquid, the infusion leaves a definite residue composed of chlorophyll and gum which will yield 38 kg. of good-quality soap per quintal of pulp.

Considering that with maceration and steeping, a yield of as much as 75 % is obtained from fibrous vegetable materials (straw, bamboo, etc.), it is evident that the utilisation of broom as a source of pulp supply constitutes a valuable supplement to forest trees whose exploitation will only be possible after a considerable time (1).

FRUIT GROWING

988 – **The Origin of the Cider Apples Cultivated in Normandy and Brittany.** — CHEVALIER, A. in the *Comptes rendus de l'Academie des Sciences*, Vol. CLXXI, No. 11, pp. 521-523. Paris, Sept. 13, 1920.

There used to exist, according to certain authors, several thousand varieties of cider apples in France, but their origin is little known. Up to the end of the last century the existence of only one species was known, viz , *Malus communis* Lamk., which combined the qualities of the wild and the cultivated apple, but not including those from the Eastern Asiatic and North American *Malus*, which are very different species. Under the present state of scientific knowledge it appears necessary to split *Malus communis* into four elementary types which can be crossed and produce numerous fertile races from which the different cultivated species originate. These are *M. acerba* Mérat. the *M. dasyphylla* Borkh. and *M. praecox* Borkh. (the last two being often combined under the name *M. pumila* Mill.), and *M. prunifolia.*

The species *M. acerba* was created in 1815 by MERAT for the apple trees which grow wild in nearly all the European forests. It had already been classified as *M. sylvestris* Miller (1759) and *M. spinosa* Roussel (1806). The latter, being the oldest name, should be retained.

It is generally supposed that French cider apples have been derived from *M. acerba* and the eating apples from *M. dasyphylla.* However, the author, after examining numerous specimens of cider apples in the west of France concluded that they have all sprung from *M. dasyphylla.*

M. acerba has grown wild in the forest of Europe since very ancient times. Apparently it was the only species used for making cider up to the IX century ; it was not cultivated but the apples were gathered in the woods. The good Normandy cider apples sprung from grafts brought from the north of Spain (Biscay and Asturia), and persisted a long time. It was between the XIVth and XVIIth centuries that the cultivation of the cider apple extended to a large part of Normandy and Britany. The species introduced from Spain was *M. dasyphylla*, which originated in Armenia and Turkestan, where G. CAPUS found it in 1881, growing wild in the fo-

(1) Another species of broom (*Spartium junceum*) has been used as a paper-making material. See *R.*, Feb., 1920, No. 204. (*Ed.*).

rests ; its cultivation has spread around the Mediterranean basin from the earliest times.

M. praecox is the " Pommier Paradis " or " Pommier Saint Jean," which is used by horticulturists as a stock to obtain the dwarf garden varieties. It originally came from Southern Russia and from Asia Minor, and appears to have been introduced into Europe at the time of the Crusades.

M. prunifolia is a native of Central Asia and its cultivation has spread, on the one hand towards Russia and Siberia, and on the other towards China and Japan (1).

The four species cited and their various descendants, about which little is known as yet, transformed by cultivation and inter hybridisation, have furnished many varieties of cultivated apples.

Occasionally the nurseries show recessives presenting almost pure parental characters. *M. baccata* Borkh. and other microcarpous Asiatic species, when crossed with the modern cultivated varieties have yielded new ones able to withstand cold and which are increasingly cultivated in Canada. But these have not yet been tried in the mountains or the North-West of France, although they offer good prospects for these regions.

989 - **Wild Apples at Tran-Nihn, Laos** (2). — MIEVILLE, R., in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Vol. II, No. 7, pp. 204-211. Saïgon, July, 1920.

There are many species of wild apple at Tran-Ninh and complete specimens have been sent to M. A. CHEVALIER (Director of the Institut Scientifique de Saïgon) with a view to their botanical determination.

The author gives the main characteristics of four species :—

SPECIES I (*Sample N°. 7*). — First branches commence 2 m., above the ground when grown in the open air, and in the forest 8 m., above the ground. Wood hard and yellow amber in colour, grain fine and close.

In 1920, flowering commenced on March 1, and lasted 8 days. The fruit was ripe at the beginning of October, and picking lasted one month.

The apples are round, bell-shaped near the stalk, yellow, and possess a pleasant odour ; the fish is too bitter for use at the table, but when sugared and roasted it is quite good. These apples make excellent cider. The trees are very productive, mature specimens giving 500 kg., of fruit at the rate of 15 apples per kg. (66 gm., per apple).

SPECIES II (*Sample Nos. 10 and 11*). — Trees as much as 12 m., high, in 1919, commence flowering on March 20 ; ripening begins at the

(1) See *R.*, July-Aug., 1920, Nos. 760 and 761. (*Ed.*)

(2) The question of the cultivation of European fruit trees in Indo-China is being followed up by MM. CHEVALIER and MIÉVILLE. Already these authors have published several articles on this subject :— Fruit cultivation in Indo-China. *R.*, July Sept., 1919, No. 908. The cider apple of the high plateaux of Indo-China. *Ibid.*, No. 909. Research on the Amygdalaceae and hardy apples of Indo China and south China, *R.* July-Aug. 1920, No. 760. See also the note by M. RETIF on Fruit trees of, Tonkin, *R.*, Jan., 1920, No. 58. (*Ed.*)

end of October and lasts one month. Fruit round, larger than the preceeding ones, and giving 12 apples per kg. (83 gm. per apple).

SPECIES III (*Sample No.* 13) — Fruit like a quince in form. Flowered in 1920 between March 20 and 27, but no fruit was set on the old trees.

SPECIES IV (*Sample No.* 14). — Fruit elongated, yellow, and perfumed. Ripening from the end of October to the end of November.

As regards fertilisation, the late varieties of fruit whose flowers are subject to rainstorms, give very irregular yields.

The wild apple exists at Chapa, in the province of Lao-Kay, and thus grows at an altitude of 1400 metres ; at Tran-Ninh it grows at 1200-1300 metres. It grows very scattered ; its natural habitat seems to be in the forests but it is also found around the Pagodas, probably planted there by the Bonzes. At the Agricultural Station of Xiêng-Khouang, an orchard was started from seedlings. The best time for this is February, when there is no fear of frost. The seeds, covered with fine earth to a depth of 1 to 2 cm., take roughly one month to spring up in the open, provided they are watered lightly and regularly. When the seedlings reached 30 cm., in height, they are transplanted to the nurseries 50-70 cm., apart. As they fear the sun they must be shaded while young or sprayed with lime-wash ; the suckers should be cut off.

Final planting can take place in the second year, in December or January after a preliminary lime-wash to protect the thin bark from the sun. They are pruned at a height of 2 m., in order to help the fruiting branches to develop. The trees begin to yield fruit about their 10th or 12th year.

The author has not succeeded in grafting the wild apple with French varieties.

He has made excellent ciders, both dry and foaming, from the wild apples of Tran-Ninh, and describes the method of preparation. The apples can also be dried according to the author's method (1), a hundred kg., of fresh fruit giving 20 kg., of dry slices. Dried apples may also be used for cider-making, but the result is not as successful as when fresh fruit is used.

The author suggests that the planting of wild apple trees along the roads of the higher regions of Indo-China should be given a trial by the Administration, in a way similar to that employed in Normandy and in several departments of France.

990 – **Parthenocarpy in the Apple-Tree.** — MANARESI, A. and ROMAGNOLI, G., in *Il Coltivatore*, Year 66, No. 22, pp. 521-525, figs. 3, Casale Monferrato, August 10, 1920.

It is well known that the fruit of the apple-tree, like that of the pear and some other trees, can develop without fertilisation having taken place. Such fruit not only differs from the normal product in being seedless, but in its shape, which is frequently characteristic, thus enabling it to be distinguished during the early stages of growth.

(1) See *R.*, Jan., 1920, No. 121. (*Ed.*)

Parthenocarpy is of direct practical interest, for seedless varieties are the best to cultivate, being less subject to those external factors that may hinder or prevent regular fertilisation.

Seedless fruit cannot, however, be obtained from all varieties of fruit-trees. R. EWERT (Blütenbiologie und Tragbarkeit unserer Obstabäume, in *Landwirtschaftliche Jahrbucher*, Vol. XXXV, Parts 1-2, pp. 259-257, 1906 ; Die Parthenokarpie oder Jungfernfruchtigkeit der Obstbäume, Berlin, 1907 ; Neuere Untersuchungen über Parthenokarpie bei Obstbäumen und einigen anderen fruchttragenden Gewächsen, in *Landwirtschaftliche Jahrbücher*, Vol. XXXVIII, Parts 5-6, pp. 767-839, 1919) recognised the parthenocarpy of the Cellini and Charlamowski varieties (Borowitski × Duchesse d'Oldenbourg) ; Mr. LESLIE (Gordon Corrie, in *The Journal of Heredity*, Vol. VII, pp. 365-369, Washington, 1916) adds the Lord Derby variety, and Sig. MANARESI (Contributo allo studio della partenocarpia nel pero e nel melo, in *Bollettino dell'Associazione orticola professionale italiana*, No. 6, San Remo, June, 1915) adds yellow Belfiore. Amongst varieties with incomplete parthenocarpy, M. EWERT classes Golden Winter Pearmain and Summer Calville de Fraas, but Sig. MANARESI has shown that, in all probability, the former should be omitted from the list. According to Mr. EWART, no parthenocarpy exists in the following varieties: — Cox's Orange, White Astrakan, Bismarck, White Winter Calville, Hawthornden, Langton Incomparable, Emperor Alexander, Lord Suffield, Cox Pomone, Downton Poppina, London Poppina, Baumann Reinette, R Burchardt, R. de Landsberg, Skiliankowoi ; and according to Sig. MANARESI's investigations, Antonowka and Reinette of Champagne.

The authors have continued the search for parthenocarpic varieties of apple-trees, and carried out experiments in 1915 and 1916, partly in the Garden of the Royal Agricultural College at Bologna, and partly in an orchard belonging to the Bologna Horticultural Establishment of BONFIGLIOLI and Son. These experiments were made in the manner advised by M. EWERT : the fertilisation of the ovules was prevented by covering the stigmata of the flowers some days before they opened, with a solution of sodium silicate or some other substance which by its mechanical and chemical action completely hinders the germination of the pollen. It is sufficient to carry out this operation on a small number of the flowers, choosing the finest and earliest, and removing the others, as well as all later formed blossoms. Near the tree thus treated, there will be one or more specimens with intact flowers, which can thus serve as controls.

The results of these experiments were as follows : — The varieties Francescona and Graham's Royal Jubilee are parthenocarpic ; Starr and Stump are partially parthenocarpic ; there is no parthenocarpy in Calville, Fanquet, Honey, Noire de David, Red Pearmain, Préfet Goully, Quetier, Rambour de Winnitza, Reinette, and Zolotoi Kourski.

In order for these results to be of general application, they will have to be confirmed by experiments carried out in other years and different places, as they are not everywhere the same.

991 – **Observation on the Apricot and Some Other Trees of Eastern Morocco.** — DUCELLIER, L. (Prof. at the Maison-Carrée School of Agriculture, Algiers), in *Revue Horticole d'Algérie*, Year XXIV, Nos. 3-4-5, pp. 45-51, figs. 38 Algiers, March-April-May, 1920

In some parts of East Morocco, apricot trees attain an unusual size, some of them measuring over 3 m., in girth ; the author himself saw one with a diameter of 1 metre.

The author suggests the formation of orchards and the planting of row of different trees on either side of the roads in damp or irrigated districts. Amongst the local species most adapted to this purpose are the " betaum," nettle tree, carob, white poplar, olive, tamarisk, and date palm.

The orchards would not only produce a large quantity of apricots that could be used fresh, but would support a canning industry. Apricot paste, fruit preserves (such as are made at Orléansville and Relizane), and dried apricots could all be made, thanks to the dryness and heat that prevail in Eastern Morocco at the end of May and in June, which is the time when the fruit ripens.

The author also gives the results of his observations on apricots in 1916-17, with the object of drawing the attention of fruit-growers to the present condition of the different varieties.

As grafting is never practised by the natives, the number of varieties is considerable, and some of the fruit is remarkably beautiful and fine. In the markets (esepcially at Taourirt, for instance), there are fruits of every shape (spherical, oval, flattened) and of variable size, from the " mech mech " which are not much larger than billiard-balls, to apricots that would be in no wise inferior to the best improved French varieties, if more attention were given to the trees. The bright colouring of certain fruits is most striking ; the colour and flavour of the pulp is also very variable.

The existence of these differently shaped fruits greatly increases the interest of the study of the apricot in Eastern Morocco, where the systematic choice of native varieties, without in any ways interfering with the experiments in improving existing varieties which are habitually carried out in new countries, would no doubt lead to the production of more uniform fruits, and at the same time, improve their quality, as the soils of certain valleys, amongst others of Oued Za, are very suited to the cultivation of the apricot-tree, and also to that of the fig.

The fig is still more commonly grown than the apricot. In the Oued Za valley, magnificent and very distinct varieties are to be seen. The fruit is delicious and is of all possible colours and shapes :— Ribbed, green or violet, plum, yellowish-green, glaucous ; elongated, pear-shaped, spherical, conical, flattened, etc. The fig-tree is worth careful study, in order to make known its best varieties. Its fruit begins to ripen at a time when the apricot crop is partly over, therefore the two kinds of trees could be worked in together, and would be a source of considerable revenue to the districts.

Other fruit-trees, such as olives, vines, pears, etc., are also worthy of interest.

The author gives a botanical description of the varieties of apricots based chiefly on the characters of the stone. He mentions the observations of numerous writers which form an extensive bibliography.

The cultivation of fruit-trees, especially of the apricot, ought to be greatly extended in Eastern Morocco. Apricot-growing is necessarily limited by the water-supply, although the tree is not dependent on irrigation, in fact being often cultivated without it in the mountains of Algeria ; in the plains, one or two waterings suffice. The climatic condition must, however, be taken into consideration, for early flowering makes the apricot very susceptible to frost.

The cultivation of the apricot is very remunerative, and it is not more difficult to grow than other fruit-trees, such as the orange, or the Japanese medlar. Further, there will always be a ready sale for the delicious preserves, etc. made from the fruit.

992 - ***Pithecolobium Saman*, Forage Tree for Tropical Countries.**— See No 970 of this *Review*. (*Ed.*)

VINE GROWING

993 - **First List of Vines with Female Flowers.** — SANNINO, F. A., in *Rivista di Ampelografia*, Year I, No. 13, pp. 189-191. Alba Livorno, July 1, 1920.

Most of the vines cultivated for their grapes are hermaphrodite, and those with female flowers are in the minority.

The two kinds of flowers are distinguished by their stamens, which are long and almost straight in hermaphrodite flowers, and short and folded over the ovary in female flowers. Further, the anthers of the former contain much fertile pollen ; those of the latter contain little pollen and that is sterile.

Amongst vines growing from seed, like wild vines, plants with male flowers are also found. They are without a central ovary but their stamens resemble those of hermaphrodite flowers. It is known that such vines bear clusters but no grapes, as fruit-dropping is the sure and inevitable rule.

Vines with hermaphrodite flowers are little if at all subject to non-setting, for if their flowers are not fertilised by fertile pollen from other vines (which is the most common form of cross-pollination), they are fertilised by their own (direct fertilisation).

The non-setting of vines with hermaphrodite flowers is due to sterile pollen, in spite of the conformation of the flowers, as the author observed at Catania, in the case of sterile stocks of " Catarratto ".

Vines with female flowers are subject to non-setting in rainy years, because they are not fertilised by the pollen of other varieties, and their own pollen is sterile. Non-setting may also take place in fine weather, should the female flowers open much later than other flowers with fertile pollen. Such is the case with a nameless variety that the author found in flower in 1893, at Mercato S. Severino (Salerno), early in July, when the grapes of the other vines were already of considerable size.

A list of vines with female flowers is not without practical utility, for in the greater number of cases, such vines are subject to non-setting to a greater or less extent, and thus their yield is variable. Therefore,

the author considers it worth while to publish this first list, compiled from the ROVASENDA collection and from the other vines at the Alba Vine-growing School. The list is not complete ; the *Vitis Labrusca* direct bearers are still wanting as well as many recent direct bearers obtained by artificial crossing in the experiments of M. COUDERC and other French and Italian investigators.

This list becomes of additional importance, when the structure of the flowers is correlated with setting and non-setting, and with the extent of the latter.

Cases of non-setting are not very common in hermaphrodite flowers, but it occurs not only in " Catarratto " in Sicily, but also in " Cabaret,' especially when this variety is grown on its own roots.

In the study of vines, the characters of the flowers are some of the most constant characters of the plant ; for this reason, a vine with female flowers, when propagated by cuttings, layering, or grafting, will always bear female flowers. This fact will be very useful in distinguishing a vine with female flowers, which cannot be mistaken for others bearing hermaphrodite blossoms.

The list in question is given below : —

Agon Mastos
Aibatly Isium
Aleático de Córcega
Alionza de Bolonia
Aluk
Augibi
Augibi de granos redondos
Bakator
Bastarda de Madera
Bellino
Bianca grossa
Bicane
Blanc d'Ambre
Bragère blanc
Campanella del Vesuvio
Catarratto
Catalanesca blanca
Catalanesca esférica
Cavarara
Crasola de Favara
Chasselas de Pondichéry
Chasselas General Lamarmora
Ciaouss
Coarna Neagra
Cola Giovanni du Vésuve
Cross n. 10 Pirovano
Diamanttraube
Dzolikoori
Duc de Magenta
Durabale
Forcella
Forlonio di Basilicata
Granella
Gentile negra de Fermo
Greca rosea
Gros Guillaume de Nantes
Gros negro oval
Gros Ribier
Huevo de gato
Kakour bigasse
Lambrusco de Sorbara extra
Lucone blanco
Madeleine angevine
Maddalena reale Pirovano
Malvasia de Asti
Malvasia de Candia
Malvasia negra
Malvasia negra de Nizza Monferrato
Malvasia negra precoz
Malvasia negra de Pinerolo
Malvasia de la Chartreuse
Malvasia de la Drôme
Maréchal Bosquet
Mallarquin
Mercoff
Montepulciano del Piamonte
Morillon panaché
Moscatel de Naples
Moscatel negro
Muscadet du Tarn

Negru Vertor
Nemoriu blanc
Nera ovale Garnerone
Nuciddaricu de Milazzo
Occhio di Pernice
Olivella
Olivette negra
Olivette noire hâtive
Paloppu bianco
Pépin d'Hispahan rouge
Perrone
Précoz de Caplat
Petrisi negro de Milazzo
Piccolit de Treviso
Pis de Chèvre blanc
Poulsard negro
Pumestra
Pumestra niura
Rattagliau
Regina de Cerdeña
Raisin Prune
Rossera
Rossetto
Sanginella
Sarfejer de Weszprin
Spat Malvasier
Semis Beson
Sin nombre
Scrosera d'Alexandrie
Sultana
Taggia blanca
Terret bourret
Trebbiano de Rome
Treggia di Finalborgo
Van der Lahn
Vetrancone noir de Vésuve
Villa Pasini
Vulpea
Zeddo faux de Pinerolo

The "uva molle" is a white table-grape that keeps a long time and is grown at Montaldo Roero (Alba district) and in two or three adjoining communes. It is not mentioned either in ROVASENDA'S *Saggio di un'ampelografia universale*, nor in the French edition of the work, although it figures in a short list compiled by ROVASENDA on the occasion of a Meeting of the provincial Ampelographical Committee held at Alba in 1875, where it is entered under the name of "uva molle."

The so-called "uva molle" variety is interesting, because it has female flowers with sterile pollen that will not germinate in a 10 % sugar-solution, as the author observed in the spring of 1920. The vine gives a certain crop, if it flowers in fine weather, as the vine-growers of Montaldo Roero know. This year, it flowered early during beautiful weather, and on June 4, the clusters had already formed, there being no sign of fruit-dropping.

994 – **Italian Riesling and Rhenish Riesling.** – SANNINO, F. A., in the *Rivista di Ampelografia*, Year I, No. 12, pp. 173-174. Alba-Livorno, June 15, 1920.

After 1893, many vineyards in Venetia, especially in the Province of Treviso, were planted with low, specialised vines. Those growing on the plain have now disappeared; some were pulled up, and others thinned out, or grown higher.

French and German vines were planted nearly everywhere, amongst those most grown, being the Italian Riesling or Wälschriesling of the Germans and Austrians. This is a rather weak vine, but produces a heavy crop of sweet grapes ripening at the third early period of PULLIAT, and in Venetia, at the beginning of October. In rainy years, its ripening is delayed, but its sugar content never falls below 18 %.

The Italian Riesling wine, is straw-coloured or light yellow, according as to whether it is made from must alone, or from must with the addi-

tion of the grape-skins ; it has a good vinous smell, and a dry, slightly bitter taste. It is rich in extract, and has the right amount of acidity. Mixed with Verdiso wine, it increases the alcohol content of the latter and perceptibly improves it. A fine wine, aging when bottled, is also made from Italian Riesling grapes, but owing to its deficiency in the characteristic bouquet and necessary flavour, it does not rank high amongst other white wines of good quality. These defects may perhaps be due to the soil, which in the " Trevigiano," contains little or no calcium carbonate.

The Rhenish Riesling produces better wine on the same soil. As its name denotes, it comes from the banks of the Rhine, and some of the finest white wines are made from its grapes. In the Venetian vineyards of Italian Riesling vines, there are always some stocks of the Rhenish Riesling variety. These are distinguished by their great vigour the colour of the woody shoots, which are brownish-red, whereas they are yellow in the Italian vines. The greatest differences occur in the buds, leaves, and berries. In the Rhenish Riesling, the small leaves of the tip of the herbaceous shoot are violet-red, and in the Italian Riesling they are greenish-yellow. The leaves of the Rhenish variety are dark-green, thick, vesicular, entire or trilobate, rounded, with a red centre to the veins and thick down on the upper surface. The leaves of the Italian vine are pale-green, thin, smooth, with five lobes, sharp teeth and have a thin down on the lower surface.

Putting aside the differences in the bunches, there are two points about the berries that prevent the vines being confused. The grape of the Rhenish Riesling has a greenish skin turning golden-yellow where most opposed to the sun, and it is covered all over with numerous dark dots. The skin of the Italian Riesling is only yellow at one spot, the pistil, exactly opposite to the point of the insertionof the peduncle. The pulp of the Rhenish grape is fleshy, and it has a slight, very pleasant odour; the flesh of the Italian grape is soft and devoid of aroma.

These differences are clearly pointed out by MOLON (*Ampelografia*, Vol. 2, pp. 1036-1039), and are shown by the two fine, accurate plates in R. and F. GOETHE's *Atlas* (Pl. V and Pl. XIX) the dots on the berry in the one case and not in the other, prevent pickers, who know nothing of the leaf-characters, from making any mistake between the two varieties at the vintage-time.

The Rhenish Riesling has not been as popular in Italy as the Italian Riesling, though it produces a better wine. In " Trevigiano ", and other Northern provinces, it is little or not at all grown. It should, however, be preferred to the Italian variety in districts, like the hills of Broni (Pavia), where the soil is calcareous.

The Rhenish vine is equally productive when grown with spurs, therefore an attempt should be made to prune it in the form of horizontal cordons with spurs, which are much more satisfactory than the tree-like forms, or long canes.

Both varieties of vine are subject to grey mould in the grapes caused by *Botrytis cinerea ;* they should therefore be grown in exposed, well-ventilated, and dry places.

Root-rot, due to *Dematophora*, was very prevalent at Conegliano, in a vineyard of Italian and Rhenish Riesling vines situated on the plain. It, however, only attacked the former variety, the Rhenish vines remaining perfectly healthy and growing vigorously. This strong growth of the Rhenish Riesling, which ripens some days earlier than the Italian Riesling, has been observed wherever the former is cultivated.

995 – **The Tokay Vines Cultivated in Italy.** – Sannino, F. A., in *Rivista di Ampelografia* Year I, No. 11, pp. 157-158. Alba-Livorno, June, 1, 1920.

The importation of foreign vines into Italy has contributed greatly to the confusion of the nomenclature.

A white vine, found by the author in many localities between the Piave and the Tagliamento, is very widely grown in Venetia under the name of Tokay.

One of the first Tokay vines notified is at Portogruaro where, on the estate of the Duke della Grazia, an excellent wine is made from the grapes. It is white, and contains over 11 % alcohol, but it soon becomes ropy. The wine is obtained by fermenting the must alone, therefore the author advises the addition of tannin, and subsequently of gelatine ; by these means, satisfactory results are obtained, even in consecutive years.

On visiting the estate in September, the author found that the vines are planted in radiating lines, in vineyards situated on the banks of the canals uniting the Portogruaro district with the Venetian lagoon. The vines are the same variaties as those cultivated in the Conegliano district, where they go by the name of " Tokay." The author was informed that they had been brought by Hungarian horse-dealers who, even after 1866, visited the markets of Venetia.

Having been taken to Alba, in 1911, this vine, under the name of Sauvignon, was cultivated in the Rovasenda collection, and was found by the author to be identical with the Venetian variety known as " Tokay." In order to prevent mistakes, it should, however, be called by the name it received at Alba.

In Venetia, the Sauvignon variety is both strong and hardy, producing a large crop of excellent grapes. If it be remembered that, at Portogruaro on the edge of the marshes, this vine when grown high and well pruned like vines on radiating cordons, yields an excellent wine, it will readily be understood how profitable it would be to extend its cultivation, not only to the plain where the Verdiso grapes grow badly and are very subject to mildew, but also to the hill-sides. It is always best to grow it in radiating lines.

Another Tokay grown in Venetia and other provinces of Italy is Furmint, which really comes from Hungary, where it produces the Tokay wines. There is a good coloured plate of Furmint (No. 13 in H. and R.

GOETHES' *Atlas*) which gives the most striking characters of its hairy leaf with its involute edges, folded over on the upper surface, thus revealing the soft velvet of the lower side without the necessity of turning over the lamina. Furmint ought to be grown in Venetia, if only for the preparation of " vini santi," which are very similar to Tohay.

The great defect of Furmint is that its has close-set bunches of small acid berries. It would therefore be well to choose cuttings from the shoots with the best bunches and, if possible, those free from this drawback. It is necessary to use plenty of superphosphates in the fertilisers.

In Venetia, the grey Pinot variety is also cultivated under the name of Tokay, and this name is used in Switzerland, Savoy, and Piedmont ; it is also found in the *Luxembourg Catalogue*, and in the Catalogue of Marquis INCISA. It is better, however, to keep the old name of grey Pinot for this vine.

In Venetia, it produces heavy crops of grapes with a large sugar content. When grown in radiating lines on the plain near Sacile, it bears a large quantity of grapes with over 20 % of sugar.

LIVESTOCK AND BREEDING

996 – **The Loco-Weed Disease.** — MARSH, C. D. (Physiologist, Pathological Division Bureau of Animal Industry), in *U. S. Department of Agriculture, Farmer's Bulletin* No. 1054, pp. 1-19, figs. 11. Washington, D. C. July, 1919. HYGIENE

The loco-weeds are leguminous plants growing in the arid and semi-arid regions of the west of the United States. They cause heavy losses amongst horses, cattle and sheep. The characteristic symptoms of loco poisoning are ; stupefication, irregularities in gait and mastication, paralysis, emaciation and eventually abstinence from all food, and then death. These symptoms are more marked with horses and cattle than with sheep. Loco is generally supposed to predispose to abortion.

Three distinct species of locoweeds are known :— " white loco " (*Oxytropis Lamberti*), " purple loco " (*Astragalus mollissimus*), and " blue loco " (*A. diphysus*). The second affects horses ; the third affects chiefly horses, but also cattle and sheep ; the first causes heavy losses of all 3 classes of animals.

While it is reasonably certain that other plants give rise to loco weed disease, the 3 already mentioned are responsible for most of the losses.

Locoed animals may be cured by careful feeding (as for example with alfalfa and grain), but the cure is hastened by the use of FOWLER'S solution (daily doses of 4 to 6 drams or 20 c. c. for not less than one month) ; and strychnin given in hypodermic doses to cattle (9 to 12 mg. daily for one month or more).

Locoweeds may be destroyed by digging, to accomplish which it is necessary to cut the root 2 or 3 inches below ground level. It is advisable to keep the stock away from badly infested areas until the grass is started.

997 - **"Coffee Bean" (*Daubentonia longifolia*) and *Astragalus tetrapterus*, Sheep Poisoning Leguminosae.** — *The Producer*, Vol. II, No. 1, pp. 31-32, figs. 2. Denver, June, 1920.

The discovery of a new sheep poisoning plant from the southern States of North America identified as *Daubentonia longifolia* " coffee bean " has been notified.

The second species noticed, namely, *Astragalus tetrapterus*, related to the locoes, has so far been observed only in the foothills of southern Utah and western Nevada, where it occurs in scattered patches, and never in large quantities. The animal staggers as it walks, and the plant is injurious to cattle, sheep and probably also to horses.

The symptoms caused by eating this poisonous weed are not especially characteristic.

When other forage is lacking, the best preventive is to remove the animals to pasture where they can get abundant feed.

998 - **" Horse Sickness " in the Belgian Congo.** — VAN SACEGHEN, R. (Directeur du Laboratoire de médicine vétérinaire de Zambi, Lower Congo), in *Bulletin agricole du Congo belge*, Vol. X, Nos. 1-4, pp. 162-172. Brussels, March-December, 1919.

" Horse sickness " has been known for over a century in South Africa, especially in Cape Colony, as well as in German West Africa, and in Rhodesia, where it has destroyed as many as 90 % of the equine population. In 1917, this disease made its appearance in the Horsebreeding Section of the Agricultural College at Zambi (Lower Congo).

The horse is the animal most attacked, mules and hinnies being less susceptible, whilst the donkey enjoys a still greater degree of immunity. The malady produces fever in goats and sheep ; it does not, however, affect man. The pathenogenetic agent is ultramicroscopic, and is found not only in the blood, but also in the exudates and bronchial secretions. Blood from the heart of a foetus borne by a mother suffering from " horse sickness " can induce the disease.

The virus is one of the polyvalent type. According to THEILER and KOCH, the disease is inoculated by *Anopheles* and *Stegomia ;* REINECKE believes that it is spread by means of ticks. WILLIAM found epizootic " horse-sickness " in a district where the only hematophagous insect was *Lyperiosa minuta ;* SCHUBERG and KUHN have produced the disease in horses by means of *Stomoxis*.

Some days before death, the temperature of the infected animal rises to from 40 to 40.9° C. The animal is depressed ; the mucous membranes are much congested, there is great difficulty in breathing, and in some cases a frothy mucus like beaten-up white of egg issues from the nostrils. The oedemata of the head and lips are very irregular. The animal does not lose its appetite, but death is occasioned by suffocation.

Post-mortem examination reveals that the blood is black and asphyxic, and infiltrations of an amber-coloured, gelatinous liquid are found in the interstices of the muscles ; very often a large quantity, sometimes several litres, of amber liquid is found in the pleural cavity. The pericardium, which is greatly distended, is surrounded at the base with a gelatinous

amber substance, which is also found in the coronal veins, and on the valves of the heart. The most constant lesion is that affecting the mucous membrane of the right *cul-de-sac* of the stomach and the pylorus ; this membrane is very hemorrhagic, and covered with large discoloured patches or ecchymoses. The mucous membranes of the colon and caecum are likewise very hemorrhagic.

The author is of opinion that the malady was spread in the Belgian Congo by sheep infected with " heart-water „ and introduced from Angola in 1917. This is rendered probable by the fact that previous to the importation of these animals, " horse-sickness " was unknown. Further, if 20 cc. of pericardial fluid taken from a sheep showing symptoms of " heart-water " are injected into a horse, the latter dies with all the symptoms and lesions that characterise " horse-sickness." EDINGTON and MORTON COUTTS believe the diseases to be identical, but THEILER and STOCKMANN do not think that the same virus is the etiological cause. The author, however, is convinced, and his experiments confirm his belief, that " horse-sickness " and " heart-water " are two varieties of the same virus, of which there are distinct races and varieties. Equidae entirely hyperimmunised to one form, can fall victims to another. The horse would be as susceptible to " heart-water " as to " horse-sickness ", but in its passage through *Equidae*, the heart-water virus would lose much of its virulence for ruminants.

According to COUTBURG, the tick transmitting the disease is *Amblyomma hebraeum*, which does not exist in Zambi.

The author believes that the disease is spread not only by *Anopheles*, *Stegomia Lyperosia*, and *Stomaxis*, but also by other blood-sucking parasites, and amongst them, a Nemocera of the genus *Culicoides*, which is only seen in the early morning, and *Tabanus*.

The horse is the animal most susceptible to the malady. Senegal horses are more resistant than others.

Mules bred from a Belgian mare are less resistant than those with a Senegal mare for a mother.

Swine, rabbits, and guinea-pigs do not contract the disease.

There is only one treatment, and that is a preventive consisting of strong doses of concentrated camphorated oils ; 10 to 20 gm. of camphor administered in the form of a subcutaneous injection have given good results, especially in chronic cases.

It appears that an animal can be rendered immune by progressive injections of serum taken from a horse that has succumbed to " horse-sickness." The serum must be mixed with half its own volume of glycerin, and submitted for 12 hours to the action of a quarter of its volume of ether.

999 – **Anti-Infection Power and Bacteriotropic Action of Anti-Streptococcic Serums Prepared from Living or Dead Bacteria.** — CARPANO, M. (Director of the Military Bacteriological Laboratory of Rome), in *Annali d'Igiene*, Year XXX, Nos. 3-4, pp. 161-168. Rome, March-April, 1920.

The preparation of the anti-streptococcic serum used for the immunisation of horses presents many difficulties when living cultures of virulent

forms are employed. This is due to the fact that sometimes, for reasons at present not wholly understood (fall of external temperature, fatigue, contusions, etc.), the animals become seriously ill after inoculation, and may actually die of true septcaemia, even when they are " serum-producers " that have attained a high degree ot immunity.

Seeing that cultures of streptococci killed by heat are, on the contrary, well tolerated by horses, the author proposed do discover whether they could not be used instead of living cultures in making anti-streptococcic serum. They therefore made two serums with cultures of living and of dead bacteria respectively, and studied their anti-infection effect on rabbits.

The results clearly showed that the serum prepared from living cultures had a *stronger immunising effect* than that made from dead streptococci. On the other hand, the *bacteriotropic power* of the two serums was nearly equal. The *opsonic index* of the serum prepared with dead bacteria was 3.72, as against 4.86 in the case of that made from living bacteria.

From his experiments taken as a whole, the author draws the following conclusions : —

(1) The bacteriotropic action of anti-streptococcic serum prepared from dead bacteria is almost the same as that of serum obtained from living streptococci.

(2) The *anti-infection* action of antistreptococcic serum obtained by immunising the serum-producing animal with living bacteria is much stronger than that of serum prepared from dead streptococci ; for this reason, although the former method is attended with the great difficulties inseparable from the use of living cultures, it is much to be preferred to the latter, on account of the greater efficacy of the product.

(3) Between the *bacteriotropic action* and the *anti-infection power* of the anti-streptococcic serum, no complete parallelism therefore exists, hence a bad opinion of the protective power of the serum itself would be formed if its bacteriotropic properties alone were taken into account.

1000 - **Warble Flies: *Hypoderma lineatum* and *H. bovis*** (1). — HADWEN, S. (Chief Animal Pathologist Ottawa, Ontario) in the *Department of Agriculture, Canada, Health of Animals Branch, Scientific Series*, No. 27, pp. 1-24, pl. 4 figs. 29. Ottawa. July, 1919.

The object of the experiments was to discover expedients to reduce the number of Warble Flies, and, consequently, the damage they occasion.

Investigations were started in 1911 at Agassiz, British Columbia, and a summary is here given of the subject matter of a series of papers published by the author. The magnitude of the still unsolved problem is indicated. A description is given of both *Hypoderma lineatum* and *H. bovis* including seasonal prevalence, oviposition and its psychic effect on animals, and methods of penetration.

(1) See *R*, Feb. 1913, No. 144 ; *R*. June 1914, No. 534 ; *R*. Sept. 1914, No. 830.

Experiments made with the larvae of *H. lineatum* showed that they choose the easiest and most non-vascular tissues in their migrations (1) and it would seem probable that even when they are newly hatched, they would have the same habits that they adopt in later migrations. If this is correct, probably they gain entrance to the œsophagus in the region of the throat. The greatest number were found in the gullets during December, and they gradually diminished until March, and then disappeared from this region. In tracing their subsequent migration, direct evidence has been secured that the larvae make use of the posterior foramen to gain entrance to the neural canal, and are found in the soft areolar tissue which surrounds the dura mater. The larva evidently makes use of the canal as an easy means of access to the lumbar region. No larvae have been discovered in muscular tissue; they follow connective tissue exclusively. The mature larvae leave the animals backs from the early part of the year up to the first days of July.

The periods for the 2 species have not been fully worked ont, but judging from records of the pupal period and the time of year the flies are on wing, *H. lineatum* begins to emerge in February and finishes about May 1st. (eggs are laid during May). *H. bovis* begins about May 1st. and ends approximately on July 1st. The average pupal period is 32.5 days and for *H. lineatum*, a little less.

In other countries no doubt variations in life history will be noticed, but the period spent by the larvae within the host must be of the same duration ,owing to the uniform animal's temperatures.

Advice is given to house animals during the heat of the day to prevent flies laying upon them. Warble grubs should be squeezed out as early as possible during the year to lessen the damage to animals and their hides.

Co-operative measures are essential if the total eradication of the pest is attempted.

1001 – **The Prevention and Treatment of Aphthic Fever by the Serum or Blood of Animals Having Recovered from the Disease.** — LEBAILLY, C., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXI, No. 12, pp. 555-556. Paris, September 20, 1920.

It has long been experimentally known that anti-aphthic serum is efficacious in the treatment of aphthic fever (LOEFFLER, ROUX, NOCARD, and VALLÉE) ; the method is, however, not generally adopted, on account of the difficulty of preparing a sufficient amount of very active serum. Serums obtained with difficulty by dint of hyper-immunising animals by means of apthic virus or blood, have to be used in large doses, and are not much more active than the serum of animals that have been cured of the diseases. The latter serum has been used by the author M. BERTIN, and several other verterinary surgeons.

The serum was obtained by bleeding 5 animals that had recovered some ten days before from a serious attack of the disease. From 3 to 6 litres of

(1) See *R.*, March 1914, No. 251 ; *R.*, May 1914, No. 445. (*Ed.*)

blood were taken from each animal. The serums were mixed and put into graduated bottles (each division marking 100 cc.) 1 gm., of carbolic acid being added to every 800 cc. of serum.

For convenience sake, blood was generally used in place of serum ; in the above-mentioned bottles was put a solution consisting of 50 cc. water 5 gm. sodium chloride + 5 gm. sodium citrate + 1 gm. carbolic acid, and blood to make up 800 cc. ; this solution was carefully mixed. The blood thus prepared had to be injected within 48 hours.

More than 500 animals, nearly all cattle, were treated, some with blood and others with serum.

The results obtained were exceedingly good, both from the preventive and curative standpoints. No case of death occurred, but the immunity was of short duration The amount of the mixture varies from 10 to 200 cc. according to the age of the animals, the strongest dose being for adults. After 8 days, the sub-cutaneous injection should be repeated.

Slow intra-veinous injection of the serum is most efficacious.

1002 – **Virulence of the Milk of Animals Suffering from Aphthic Fever.** — LEBAILLY C., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 6, pp. 372-375. Paris, August 9, 1920.

It has long been known that the milk of animals suffering from apthic fever is contaminated with the virus of the disease. This was attributed to the presence of vesicles on the teats, which frequently occurs, and to their rupture during the operation of milking. TERNI has observed that the aphthic virus is carried off by the milk.

The authors' experiments have shown that the virulence of the milk is a very early symptom of aphthic fever ; before any other sign of the disease manifests itself, and while the health of the animal appears in no wise affected, its milk is already virulent.

The passage of the virus into the milk is the chief cause of the spread of the disease and of the mortality among young animals ; it explains occurrences that would otherwise be most mysterious. On visiting the centre of the epidemic, the observer cannot fail to be struck by the fact (which seems paradoxical at first sight) that the first cases of aphthic fever are those of young calves, shut up in the shed and never going out. These animals are attacked by a rapidly progressive malady, and die suddenly although aphthic fever has only just made its appearance on the milch cows, or is not even recognised till the next day, when the vesicles break out. As a matter of fact, this eruption, though generally regarded as an initial symptom, really indicates an advanced stage of the disease, and is the forerunner of complications due to secondary infection. The same remark applies to the disease in the case of pigs. The large amount of virus introduced into the digestive system by the ingestion of the milk explains the acute nature of the attack on young animals and their sudden death even before the appearance of the vesicles. The virulence of the milk develops at a very early stage, and is parallel to that of the blood during the time when the temperature of the animal is rising.

These facts explain the discouraging results obtained by breeders who have taken the trouble of boiling the milk given to calves and pigs ; this precaution was excellent but it was deferred until too late.

On certain farms, disastrous results ensue from the practice of using the unboiled milk of cows supposed to be healthy. When aphthic fever breaks out among stock, there are always some individuals which, though apparently uninfected, are yet in the fever stage of the disease. Their milk contains the virus (at that moment at the height of its activity), and the animals fed with this milk at once contract the disease.

The great mortality among calves during the prevalence of epidemics of aphthic fever can only be prevented by using a thermometer, in order to detect the first symptoms of the disease, and by boiling the milk and sterilising all vessels with boiling water.

1003 – **Uterine Disease in Cows. The Extent to which They are Due to the Bang-Stribolt Bacillus.** — Rivabella S. (Royal Veterinary College of Modena), in *La Clinica veterinaria*, Year XLIII, Nos. 13-14, pp. 329-349, Bibliography of 29 publications. Milan, July 15-30, 1920.

Inflammation of the uterus is one of the most common causes of sterility and abortion in domestic animals. In order to diagnose the symptoms with certainty and accuracy the author proposes (*La Clinica veterinaria*, 1917, Nos. 12 and 13) a cytological examination of the uterine secretion collected *in vivo* from the animal with special precaution and according to a new method.

In the present article, the author describes a series of experiments made for the purpose of comparing the results of his method of diagnosis with those of methods based exclusively upon bacteriology and serology, in order to determine whether the lesions of the uterus are always accompanied by the Bang-Stribolt bacillus.

Out of more than 100 cows examined, 76 were proved by cytological examination of the uterine secretion to be suffering from disease of the uterus. This diagnosis was confirmed in the case of some cows by means of microscopic examination, and in that of others by careful observation of the symptoms. Of these 76 cows, only 10 gave a positive result to the agglutinaton test for the Bang-Stribolt bacillus. Thus, it would appear that this micro-organism is only the cause of uterine disease in a very limited number of cases.

This supposition agrees with the observations of Prof. Stazzi upon the distribution and gravity of cases of abortion and vaginitis in the various regions of Italy. He noticed that epizootic abortion due to the Bang-Stribot bacillus is a disease peculiar to large farms, where cattle breeding is intensive, and the animals are kept in the sheds and stall-fed throughout the year.

1004 – **Treatment of Surra in Camels by Intravenous Injections of Tartar Emetic.** — Cross H. E. (Camel Specialist, Sohawa, Punjab, in *Agricultural Research Institute, Pusa, Bulletin* No. 95, pl. 4. Calcutta, 1920.

In 1917, the author treated and cured 6 camels attacked by surra by means of intravenous injections of a 1 % solution of tartar emetic.

Taking into account the fact that only a small number of animals were treated, it may however be concluded that tartar emetic gives promise of success. The method of treatment is described and stress is laid on the following points: 1) that the solution should not be injected subcutaneously but into the vein to prevent sloughing; 1) that injections should be given during the intervals between the paroxysms; 3) that a 60 cc. of a 1 % solution can be safely given to fully grown camels if the amount is given in 4 injections with a 2 or 3 hours interval between each; a single dose results in death.

1005 – **Study on Avian Plague.** — Jouan, C. and Staub, A., in the *Annales de l'Institut Pasteur*, Vol. XXXIV, No. 5, pp. 343-357, Bibliography of 24 publications. Paris, 1920.

Avian plague which was recognised in 1880 by Rivolta and Delprato, began to be studied in 1901 by Centanni, and then by Maggiore and Valenti, Lode and Gruber, Dubois and other investigators.

In 1916, the results obtained from these researches were that fowls pheasants, parrots, and goslings less than 6 months old were all found to be susceptible to the disease. Adult geese contracted it only if inoculated with virus under the dura mater. An epidemic was observed among wild ducks (*Anitra germana*). The virus passes through Berkefeld and Chamberland filters and Bechholds ultra-filter. According to these experiments, the size of the pathenogenetic agent is 2.4 million parts of a millimetre; a subcutaneous inoculation of 1/10 000 000 c. c. or even less is often sufficient to produce death. In the case of the fowl, the blood and all the organs, as well as the contents of the intestine, contain the virus; in that of the gosling, the blood and brain contain it for the 3 first days after inoculation; in the adult goose only the brain.

It is generally acknowledged that the blood corpuscles contain more virus than the serum; in fact if fresh globules are added to virulent serum, the latter yield up some of its virus to them.

In its resistance when in glycerin this virus resembles the pathogenetic agents of rabies, small pox and syphilis, though from the effect of saponin, which does not act upon bacteria, but destroys trypanosomes, etc., it would seem to be a protozoon.

With regard to resistance to heat, the virus is killed after 5 minutes heating at 60°C, according to some observers; but others state that it can withstand 70°C, and is destroyed by 80°C. When in the brain, the virus is said to resist 4 hours' heating at 65-80°C.

Hitherto, all attempts at vaccination with heated virus have failed. Fowls however, have been inoculated with the brain of an infected gosling, dried in a vessel full of caustic potash.

Serum from a fowl that has recovered from the disease destroys the virus *in vitro*, and protects fowls from infection. Sheep inoculated with the virus provide a serum of little activity.

The authors have found that blood retains its virulence for a long time in closed flasks: viz. from 12 to 18 months in the refrigerator, for 25 days at a temperature of 37°C. Entire bood is very rich in virus; 1/11 000 000 cc. of

it kills an animal quickly ; the brain contains the same amount of virus, but there is a little less in the pericardiac fluid.

Twenty-four hours after inoculation, fowls show signs of depression, they ruffle up their feathers, close their eyes, and their temperature rises to 43.5° or 44°C. Than the temperature falls, somnolence increases, and the birds die (37-38°C) without any symptoms of nervous disturbance.

The authors have succeeded in transmitting the pest from pigeon to pigeon after transmitting it consecutively 4 times, beginning with a young bird 3 to 4 weeks old and finishing with an adult pigeon. The fifth pigeon was very seriously ill, but the sixth pigeon, and a fowl inoculated with portions of its brain and some of its blood taken on the 12th day when it appeared to have recovered, were not killed.

Towards the fourth day after intramuscular or intracerebral inoculation, the pigeon shows signs of nervous derangement ; it cannot keep its balance, which is a sign that the virus is chiefly lodged in the encephalus. In spite of this, however, all the subjects of the experiment did not succumb.

According to the authors, infection can be produced by merely introducing the virulent blood into the oesophagus, or even sprinkling it over some grains of food ; experiments proving these facts are cited. It is probable that the excrement on the ground where the fowls range is a source of contagion.

The following data indicate the heat resistance of the virus :—

At 44°C., after 24 hours, the virus is not killed, but is less active.
At 46°C., after 2 days, the virus is not killed.
At 47°C., after 3 days, the virus is killed.
At 55° C., after $^3/_4$ hour, the virus is not killed.
At 55°C., after 1 hour, th virus is killed
At 60°C., 10 minutes suffice to destroy the virus.

When virus killed by heat was used for inoculation, it was found that virulent blood kept for 3 days at 46°-47°C., and introduced in sufficient quantity (10 cc.) into the mucsles was able to confer immunity.

Considerable resistance, if not complete immunity, was obtained by the inoculation of heated virus, or by sero-vaccination.

Experiments are described which prove that inoculated and hyper-immunised fowls furnish an active and antibacterial serum, which is best obtained by means of intravenous inoculation.

If a mixture of serum and virulent blood is used, the inoculated animals are not ill, but after 10 days they succumb to a virulent test. In order to prevent this destructive action of the serum upon the virus, the authors thought of impregnating the latter with the anti-bodies of the serum. The serum,on being heated at 56°C., for half an hour still destroyed the virus. They then removed the alexine present in the virulent blood, and which had the power of re-acting on the serum. In order to effect this, rabbit blood-corpuscules were used that had been washed and restored to the original volume of the blood. In order to remove the alexine in 8 cc. of fowl serum, 3 cc. of blood must be taken from a rabbit, and the corpuscles washed 3 times, the last water being replaced by the 5 cc. of fowl serum,

with which the corpuscles are emulsified. After contact for 30 minutes at 33°C all the alexine will have disappeared from the serum.

If it is a case of the entire blood of avian plague (not only the serum, for each 8 cc. of virulent blood freed from fibrin, the corpuscles in 2 cc. of rabbit blood should be taken. In order to be more certain the author used 3 cc. and thus obtained a virus free from alexine, which after being mixed with blood taken from a hyper-immunised fowl and heated to 56°C., can be employed for inoculation after contact for 24 hours at 33°C.

After experimenting with different proportions of serum and virus, it was found that it was possible to inoculate fowls with this mixture, but the authors do not deny that the process should be improved still further.

All their attempts at cultivating the virus by the usual methods proving vain, they experimented with yolk of egg, and found that the virus developed in an incubated egg when the incubation had continued for at least 3 days ; this may perhaps be due to some change in the egg which is favourable to the growth of the virus.

FEEDS AND FEEDING

1006 – **Comparative Return of Albumen and Carbohydrates.** — GOUIN, A. and ANDOUARD, P., in *Bulletin de la Société scientifique d'Hygiène alimentaire*, vol. VIII, No, 6,pp. 376-378. Paris, 1920.

Physiologists are still engaged in discussing the question whether albumen on account of its complicated structure does not require a much larger expenditure of energy in its digestion than starch and sugars. If this be the case, as is maintained by CHAUVEAU, its nutritive return would be considerably diminished. Although the authors' experiments were not undertaken for the special purpose of deciding the matter they yet afford some useful data.

In the many years during which they have drawn up the nutritive balance for calves fed on maximum rations, the composition of the latter was very varied. The nutritive ratio of the feed in some cases varied from 1 to 3.5, and in others as much as 1 to 8.

The amount of the nutritive principles ingested remained, however, always the same, which would seem to show that the digestion of albumen is no slower than that of carbohydrates. The animals grew as rapidly on the one diet as on the other. The sum of the nutritive principles absorbed in growing and for the maintenance of the body never changed, however much the rations varied.

Numerous experiments with pigs, which, however, were not carried out with the same accuracy, confirmed the results of the experiments on cattle.

In their experimental piggery, they carried out as intensive a system of breeding as possible, the animals from the beginning being given as much as they could eat. The rations consisted entirely of concentrated feeds, often diluted with a little skim milk. The pigs were weighed every week.

For a long time, the authors thought it best only to give the pigs the full amount of nitrogen required for flesh-formation and the reconstruction of waste tissue. The nutritive balances for 5 consecutive months showed that the animals had never received less than was needed for these purposes.

For the rest of their vital expenses, these being by far the most important, they drew with equal success upon the starch or sugars.

In the case of very young animals, the nutritive ratio was as 1 : 5; later, it rapidly widened and ended by being 1 : 10 or even more.

As starchy substances and sugars were not available for stock-feeding during the war the authors were obliged to have recourse to 2 cakes viz. groundnut cake which contains excess nitrogen and has a nutritive ratio of 1 : 1 at most, and palm-nut cake of which the ratio is 1 : 4,5.

As a rule, the pigs did not eat palm-nut cake very readily; in order to induce them to consume the enormous rations required by intensive breeding, it was necessary to mix the cakes, giving half of each. Then the nutritive ratio fell to 1 : 3, when the average with starchy food had previously been 1 : 8. The average daily gain in weight of the 26 pigs raised from 1910 to 1916 with this wide ration was as follows :

Pigs weighing.	18 to 30 kg..	605 gm
Pigs weighing	30 to 100 »	720 »

or a daily gain, for each pig weighing 18 to 100 kg,, of 700 gm. The daily increase in weight of the 11 animals which had to be fed on a very narrow nutritive ratio from 1917 to the beginning of 1920 was as follows :

Pigs weighing	18 to 30 kg.	536 gm.
Pigs weighing	30 to 100 »	718 »

or an average gain of 684 gm.

Although when the pigs were very young, lower results where obtained with nitrogen than with starch, the authors are of opinion that no decisive conclusion can be drawn from this fact.

On the other hand, it seems certain that, in spite of the difficulties entailed in the digestion of nitrogenous substances, omnivorous and herbivorous animals alike are able to make use of the same amount of nutritive principles, whether the food contains excess nitrogen, or only the necessary amount, and that the nutritive return is the same in both cases.

These experiments on young animals and these nutritive balances, clearly prove that for the maintenance of the body and provision for growth, the value of albumen is not below that of starch and sugars.

1007 – **Some Feeding Experiments with Dried Blood in Great Britain.** — Newman, L. F., in *The Journal of the Minister of Agriculture*, Vol. XXVII, No. 3, pp. 266-271. London, June 1920.

In recent years, several firms have placed dried blood on the market as animal food, and considerable claims have been made as to the value of this preparation when used as part of a fattening animals rations. It was therefore considered desirable by the Food Investigation Board to institute a series of trials in which blood was the main source of nitrogen.

Dried blood, when properly prepared, is a dry powder with a little smell, a pleasant meaty taste, and a salt flavour.

A number of trials have been carried out by different investigators on dried blood, and the results have indicated that it possesses considerable food value whe added to a mixed diet, but it was decided to restrict the

experiment to the effect of blood as an addition to a carbohydrate diet. For this purpose two series of experiments were arranged : 1) blood as an addition to maize meal ; 2) blood as an addition to wheat offals.

Twenty-eight pigs were selected and divided into 4 lots of 7 pigs each, each lot being arranged to average, as nearly as possible, the same live weight.

Experiment I. — The 4 lots were fed as follows : — I wheat offals only ; II maize meal only ; III, wheat offals and dried blood ; IV maize meal and dried blood. In addition, each pig received ½ oz. bone meal daily. The amount of blood fed to each pig in Lots III and IV was 2 oz., per day to begin with, rising gradually to 6 oz., per pig per day, an average of 4 oz., per day ; an extra 5 lb., per pen was allowed so as to bring the total to 1.25 cwt., in all for both lots of blood-fed pigs. Each lot received altogether 1.25 cwt., of blood during the 11 weeks of the experiment.

In both diets, the blood-fed pigs were much livelier and more hungry than the controls. The pigs were weighed at weekly intervals and after 11 weeks feeding gave the following results : —

Lot	Weight at start	Weight at finish	Gain in Loss
	lb.	lb.	lb.
I	381 3/4	600	218 1/4
II	409 1/4	406	—3 1/4
III	402 1/4	686	283 3/4
IV	415 1/4	623	207 3/4

The pigs in Lot II showed very little appetite, and after a week or two took their ration of plain maize meal only with reluctance and when pressed by hunger ; this explains their decrease in weight.

Experiment II. — To ascertain if the addition of a small amount of fresh vegetable food, might possibly affect the general metabolism of the animals.

The pigs in Lot II were divided into 2 pens, and one pen received a single kohl-rabi plant per pig per day, in addition to the diet, for another period of 4 weeks. With the exception of Lot III, when there was no marked difference in weight between the 2 pens, the other 3 lots gave evidence of a distinct difference in weight between the pens which received vegetable food compared with the control.

Conclusions. — The results obtained indicate that the addition of blood to an ordinary farm ration of wheat offals may cause a very considerable gain in weight compared with the results obtained from a farm diet of offals only, while the addition of blood to plain maize meal gives an increase equal to results obtained from feeding offals only. (These results with maize meal alone compare exactly with those obtained by American observers who undertook experimental work of feeding maize to pigs as a comparison with maize + casein).

The addition of a small quantity of fresh vegetables to the diet showed a very considerable gain against an ordinary ration, but their use appeared to be unnecessary when a full diet of wheat offal plus blood was fed.

The author adds that this part of the experiment is tentative only, and requires further trial with a larger number of pigs before any definite conclusions can be drawn.

1008 – **Sunflower Silage.** — NEIDIG, R. E., and VANCE, L. E. in *Journal of Agricultural Research*, Vol. XVIII, No. 6, pp. 325-327. Washington, D. C., Dec. 15, 1919.

In many parts of the Pacific Northwest, the selection of a suitable crop for silage purposes is a matter of some difficulty because of the variable climatic conditions. New crops that are more or less resistant to drought and that will yield a heavy crop of green material are greatly desired for this purpose. The results obtained by ARNETT and TRETSVEN in 1917 on sunflower silage were so encouraging that the Idaho Experiment Station started to grow for silage. During the early part of September, 1918, the sunflowers were cut and made into silage, and it was with the said silage that the authors undertook chemical experiments with special attention paid to the acid formation. As the crop of sunflowers was not sufficient to entirely fill the silo, maize was added in adequate quantities. The samples of silage were taken in January: Sample 1 was taken at a depth of 2 ft: the silage was dark in colour and had a strong, disagreeable odour; Sample 2 was taken at a depth of 6 ft., was lighter in colour with only a slight disagreeable odour; Sample 3 was taken at a depth of 9 ft., and possessed all the appearances of having undergone normal silage fermentation.

The authors determined the kind and amount of acids found in each sample, with a view to establishing the type of fermentation in each case.

The acid fermentation of No. 1 does not appear to be normal, for butyric acid is present in a large quantity, while only a trace of lactic acid is found. Sample 2 also contains butyric acid and therefore can not be classed as first grade silage. Sample 3, however, showed an acid fermentation similar to that found in good maize silage. The abnormal fermentation of Samples 1 and 2 is no doubt due to the fact that 10 days elapsed between the filling of the silo with sunflowers, which allowed air to penetrate the silage. The results with Sample 3, show that under proper conditions, sunflowers will produce an excellent silage: The chemical analyses of the 3 Samples are given as follows (see Table p. 1164):

The composition of sunflower silage compares very favourably with that of maize silage. No data are at present available on the digestion coefficients of the sunflower silage. Practical feeding, however, indicates that it is equal to maize silage for many purposes, and may quite well be used as a good substitute in districts where maize can not be grown.

Composition of Sunflower and Maize Silage.

Kind of Silage	Water	Ash	Protein	Crude fibre	Nitrogen free extract	Ether extract
	%	%	%	%	%	%
Sunflower, Sample number						
1	76.6	2.4	2.3	7.1	10.5	1.1
2	78.0	2.7	2.6	5.6	10.1	1.1
3	81.0	2.2	2.4	4.6	8.9	1.1
Average	78.5	2.4	9.8	5.8	1.1	2.4
Maize (average of 121 analyses)	73.7	1.7	2.1	6.3	15.4	0.8

1009 – **Food Value of Fruits of *Pithecolobium Saman.*** — See No. 970 of this *Review.*

HORSES

1010 – **Metrical Studies on the Mule in France.** — PORCHEREL, A., in *Revue vétérinaire* Vol. LXXII, No. 6, pp. 338-345, No 7, pp. 415-429. Toulouse, June and July, 1920.

The aim of the author was to test, by means of a series of measurements of the mule, the truth of the hypothesis that in hybrids, there are both juxtaposition and fusion of the parental characters, and that in the case of crosses between 2 domestic species, the offspring most resembles the parent which has been least altered by domesticity.

The author himself took the measurements of the mules and asses that he uses as a basis for his conclusions, and sets forth in a series of tables. The data respecting the measurements and proportions of the horse he took from well-known sources and especially from M. F. X. LESBRE's treatise entitled " *Précis de l'extérieur du cheval* ". From the data, the following facts have been collected :

LENGTH OF EARS. — This varies in the mule,

from 40 to 47.1 % of the head length in 44 % of the animals examined
from 35.7 to 40 % » » » » 32 »
from 30.8 to 35.7 % » » » 24 %

In the ass, the ears are nearly always more than half as long as the head.

HEIGHT AT WITHERS. — In the horse this is usually 2 ½ heads, in the mule, with few exceptions, it is nearly always below 2 ½ heads, though it only varies by 1 to 4.5 cm ; in the ass, the height is less in proportion to the length of the head than in the mule.

PROPORTION BETWEEN THE CHEST AND THE HEIGHT OF THE GIRTH. — The height at the withers depends upon two elements of which the proportions are very variable, i. e. the chest and the girth. On an average, in the case of the horse, the first is $^{1}/_{10}$ head more than the second, that is, the total height at the withers which is 2 ½ heads, is made up of chest 1 $^{2}/_{10}$ head, chest and girth height, 1 $^{3}/_{10}$ heads.

In the mule, the girth height is always from 3 to 19 cm. more than the chest height. As a rule, mules stand higher, the chest being sunk but little between the fore-limbs. This difference is less striking in the case of the donkey. According to the writer's measurements, the proportion between

chest and height varied from 2.05 to 2.1 in the mule, and from 2 to 2.17 in the ass.

RADII OF THE FORE LEG: *Length of shoulder.* — In the horse, the length of the shoulder measured from the extremity of the withers to the point of the fore-leg is about 1 head, varying between 5 cm. more and 5 cm. less. The shoulder length of the mule is a little less than the head length, but is longer than in the ass, thus approaching more nearly that of the horse.

Slope of shoulders. — A shoulder is oblique when it forms an angle of about 55° with the horizontal. In 11 out of 21 mules measured by the author, the slope of the shoulder was from 50 to 59°; in 9, it was from 64 to 69°, and in 1, it was 70°. The proportion of mules with sloping shoulders was in this case 52.3 %, i. e., more than half.

Length of fore-limb. — In the horse, the distance from the point of the shoulder to the point of the elbow is about $^{2}/_{3}$ of the head length.

In the mule, the author found a length of arm varying from $^{2}/_{5}$ to $^{3}/_{5}$ of the head, and in the ass an arm length equal to $^{3}/_{5}$ of the head. The length of the arm of the mule approaches that of the arm of the ass, one of the upper radii being shortened.

The inclination of the arm. — According to the author, this varies in the mule from 30 to 46°. the scapula-humeral angle varies from 92 to 111°. As a rule, the slope of the arm is inversely proportional to that of the shoulder, but great variability is met with.

The length of the two upper radii of the fore-limb (the shoulder measurements resembling those of the horse, and the arm measurements those of the ass), together with variable slope of the arm, indicate a juxtaposition of characters.

Length of fore-arm and cannon-bone. — In a horse of average proportions, the distance from the point of the elbow to the knee-joint is equivalent to the distance of the knee-joint from the ground, and these two measurements added together are $^{3}/_{4}$ of the head.

In horses that stand high, especially race-horses, the second measurement is generally 3 to 5 cm., more than the first, whereas in other horses, especially work-horses, the reverse is the case. The measurements taken by M. LESBRE show that the pre-brachial length, although not absolutely invariable, remains nearly $^{3}/_{4}$ of the head, and that it is the metacarpo-digital measurement that is especially changeable.

The author found that the pre-brachial measurement of the mule is always less (variation from 2 to 5 cm; equality in 2 cases out of 21) than that of the metacarpo-digital; in most cases, it is $^{2}/_{3}$ of the head, and only in very few cases does it attain $^{3}/_{4}$.

In the mule, in most cases, the cannon-bone region is $^{1}/_{2}$ the length of the head; sometimes, however, it exceeds the half by from 6 to 10 cm. The metacarpo-digital region is generally $^{3}/_{4}$ the length of the head.

The fore-arm region in the ass is about $^{3}/_{5}$ of the head, and that of the cannon-bone is half the length of the head, as in the case of the mule. The metacarpo-digital region is $^{3}/_{4}$ of the head.

As regards its fore-arm, the mule is intermediate between the ass and the horse and, in some cases, nearer to the horse. In all three animals, the metacarpo-digital region is about $^3/_4$ of the head.

Radii of the hind-limb. — In the horse, M. LESBRE reckons at about $^5/_6$ of the head the distance: (1) From the knee-cap to the haunch; (2) from the knee-cap to the point of the croup; (3) from the knee-cap to the point of the hock.

The vertical height of the point of the hock he reckons to be, on an average, $^{19}/_{20}$ of the head, and the distance between the point of the hock and the spur to be $^3/_4$ of the head or 2 or 3 cm., less.

The measurements taken by the author show that in the mule: (1) The distance from the knee-cap to the point of the croup is usually the same as that from the knee-cap to the haunch; but in 11 cases out of 21, the latter is from 1 to 10 cm., longer; (2) the distance from the knee-cap to the point of the croup is generally $^3/_4$ of the head; (3) the distance between the knee-cap and the haunch varies between $^4/_5$ and $^3/_4$ of the head; (4) the distance between the point of the hock and the spur is about $^3/_4$ of the head; (5) the distance between the knee-cap and the point of the hock varies between $^3/_4$ and $^5/_6$ of the head; (6) the vertical height of the point of the hock above the ground is very variable; in 2 cases out of 21, it was equivalent to the length of the head, in other cases, it was $^4/_5$, $^5/_6$, $^6/_7$ or even $^{11}/_{12}$ of the length of the head; (7) the slope of the thigh is more accentuated than in the horse.

In the donkey: (1) The distance from the knee-cap to the point of the croup, and from the knee-cap to the haunch was equal in 2 cases out of 3 ($^5/_6$ of the head); (2) the distance from the knee-cap to the point of the croup was $^3/_4$ and $^5/_6$ of the head; (3) the distance from the point of the hock to the spur was $^2/_3$ and $^3/_4$ of the head; (4) the distance from the knee-cap to the point of the hock was $^3/_4$ and $^4/_5$ of the head; (5) the vertical height above the ground of the hock was equal to the length of the head, except in one case, when it was $^4/_5$ of it.

These last measurements vary very greatly in the mule, but they more nearly approach those of the donkey than of the horse for the upper radii are shorter in both mule and donkey; this also holds good for the arm.

Length of body. — In the horse, the length of the body measured from the point of the shoulder to the point of the croup should (according to BOURGELAT) equal the height of the withers (2 $^1/_2$ heads) M. LESBRE has shown that most fine horses are longer than they are high (2 $^6/_{10}$ heads) and that the length from the point of the shoulder to point of the ischium varies from 2.45 heads to 2.75 heads.

The author's measurements show that, as a rule, mules are longer than they are high and that the length from the point of the shoulder to the point of the ischium varies from 2.3 heads to 2.7 heads. In small asses (those from Africa) the difference between the length of body and height is a little accentuated.

LENGTH OF NECK. — In this the mule more closely resembles the horse than the ass.

GIRTH OF CHEST. — The proportion between chest girth and height is much less in the mule than in the horse.

CROUP. DISTANCE FROM SCAPULA TO ILIUM. — In the mule, as in the ass, the croup is nearly always wider than it is long ; in the mule its length varies between $^4/_3$ and $^5/_6$ of the head ; in the ass, it is as much as $^2/_3$ of the head. The croup of the mule is usually more sloping than that of the horse, without however always being sharp. The scapula-ilial distance always exceeds the head length.

CIRCUMFERENCE OF CANNON-BONE. — This, in the mule, is about $^1/_9$ or $^1/_{10}$ of the chest circumference. In the ass, it is rather more (about $^1/_8$).

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It would appear from an examination of these measurements that in the mule there are certain characters intermediate between those of the ass and horse (fusion of characters of parents), whereas others belong either to the horse or the ass (juxtaposition). There is great variability. To try to assign fixed morphological characters to the mule would be to show ignorance of the laws of heredity.

The mule has 2 and sometimes 3 chestnuts, which are always less developed on the hind-legs.

The fore hoofs are generally intermediate between those of the horse and ass, and are more rounded than the hoofs of the latter. The hind hoofs resemble those of the ass.

The hair is more developed in the mule than in the ass ; this is especially the case in the tail. The mane and tails of some mules differ little from those of horses.

The sharp croup known as the mule's croup (even when it occurs in horses) is found in the majority of mules, but some have rounded croups. The author found sharp croups in 53 % and rounded croups in 45 % of the mules examined ; those with rounded croups were almost all of French origin.

The back of the mule is nearly always straight, being convex only in rare cases, and the author met with 2 young animals, 4 and 6 years of age respectively that had the defect of being saddle-backed The eye is not always as covered as that of the ass, therefore it is an exaggeration to say that the mule has a gloomy, unintelligent expression.

The mule has a good memory for places ; when well-trained and properly treated it is not obstinate, and is a most useful animal. It, however, is more irritable and less good-tempered than the horse.

1011 – **Investigations on the Hair of Different Breeds of Cattle.** — CAMEK, J. (Veterinary Institute and Institute of Animal Industry of the Polytechnic High School Prague), in *The Journal of Agricultural Science*, Vol. X, Pt. 1, pp. 12-21, bibliogr. of 12 publications Cambridge, Jan. 1920. CATTLE

Investigations have recently been made under the direction of Prof. KAŠPÁREK in connection with relations existing between certain characteristics concerning the type of hair produced, and the age, quality and

breed of the cattle. As a result of his investigations, KAŠPÁREK came to the following conclusions:

The hair of bulls has usually a thicker fibrous layer than that of cows. The cross section is different according to sex.

2) There is no relationship between the colour of hair and the development of the fibrous layer and the medulla, but exception must be made with white hair, which in both sexes has a medulla of greater diameter than coloured hair.

3) The hair of prairie and valley cattle has a more strongly developed fibrous layer than that of mountain cattle.

4) The nature and form of the hair is closely convected with the breed of cattle involved.

5) The relationship between the diameter of the medulla to the cortex which is a characteristic of the original stock, remains unchanged, even when the animals are transfered to other countries, and is not influenced by insufficient feeding and selective breeding. It is supposed that the relation between the medulla and cortex in cross bred animals of two heterogeneous breeds shows the dominant or recessive characters just as much as other morphological and physiological characters.

6) There seems to be no fixed law which establishes a relation between the diameter of the hair and the breed of cattle.

The author made further investigations with a view to determining the length, width and ash content of hair in different animals according to their sex and breed.

The hair of the following breeds was investigated: Lowland animals, black chequered and red chequered Dutch cows; red chequered East Friesland cows; shorthorn brown Alpine cattle; Montafons and Swiss breeds, shortheaded dark red Pinzgauer; Frontosus breed, and roan coloured and light-coloured Simmentaler cattle from Bohemia. Other additional studies were made which refer to the crossbreed Bernese × Hanak (red chequered type from Moravia). The hair was collected in November, December and January, at which time the greater part of the covering hair had already developed, and was taken from the same parts of the body in every case. One hundred hairs were examined from each type, and the measurements and characteristics ascertained.

Measurements of the length of hair:

East Friesland Breed. The average length of hair was: (*a*) Red hair: in 4 cows, 2.58 to 3.15 cm.; in 6 head of young cattle 6 months to 2 years old., 4.16 to 5.93 cm. (*b*) white hair: with one exception, shorter than the red ones, 2.96 to 6.09 cm.

Dutch breed cattle: (*a*) black chequered (1) black hair in 5 cows: 3.05 cm., in 1 cow 7 years old; 1.84 cm., in 1 heifer 2 years old. 5.50 cm., in 1 bull 4 years old. 3.82 cm.: (2) white hair, 1 cow (7 years) cm. 1.71 cm., heifer (2 years) 4.68 cm., 1 bull (4 years) 3.30 cm., (*b*) Red chequered (1) red hair: 3 cows, 1.98 to 2.90 cm.; 1 cow (4 years) 2.91 cm.; 1 heifer (2 years) 4.65 cm.; ditto (1 year) 5.06 cm.; ditto (6 months) 2.74 cm,; 1 bull (4 years) 3.49 cm.; ditto (2 years) 5.70 cm.

(2) white hair, 1 cow (4 years) 2.61 cm,. 1 heifer (1 year) 4.21 cm., ditto (6 months) 2.58 cm.,; 1 bull (4 years) 2.10, ditto (2 years) 5.20 cm.

Bernese-Hanac chequered cattle: Average length of red hair in 15 cows was 2.12 to 3.33 cm.; for white hair 1.75 to 3.25 cm.

Simmentaler Breed: The white hairs were shorter than the red.

Montafon Breed. 10 cows average length 2.83, 11 heifers (from 3 months to 2 years old), 3.15 to 4.76, 4 steers 3.19, 2 oxen (6 years) 2.72.

Swiss Breed: Length of the hair varies between 2.26 to 3.18 cm. in 6 cows; in a steer (2 years) 3.96 cm.

Pinzgau Breed: Average length in 3 cows 1.86 to 2.93 cm.; in a heifer (3 years) 3.85 cm.

Measurements of the thickness of hair. — In the determination of the diameter, the measurements were made at a magnification × 80, and the relation of diameter to length of hair.

The results show that there is no regular relation between diameter and length. The longer hair, is as a rule, thicker and stouter, and in short hair, the diameter is proportionately greater than in long hair.

Ash content of hair. — Ninety-three analyses were made on white, black and coloured hair taken from various breeds of different age and sex. Results show: (1) that the ash content of hair is not characteristic for a given breed; (2) that the white hair, is on the whole less rich in inorganic material than coloured; (3) that the more intensely coloured hairs contain the greatest proportion of ash. Similar results were obtained as regards sex: the hair of bulls of all breeds was richer in ash than the hair of cows of the same age, and the hair of oxen had the same amount of ash as that of cows

The following conclusions have been drawn as a result of these investigations:

(1) The maximum length of hair in pure bred animals is found to be between the ages of 6 months to 2 years. Older animals have shorter hair. The hair of bulls is always longer than that of cows and oxen of the same age. In a given animal the white hairs are shorter than the coloured ones; there is a large variation in the measurements of the coloured hairs in the individual animal.

(2) Young cattle up to the age of 3 months have the thinnest hair. After this period, the thickness of the hair is the same as that of adult animals. Bulls have always thicker hair than cows and heifers of the same age. The white hair of a given animal is thinner than that of the coloured hair.

(3) The relation of thickness of hair to length is not always the same With short hairs, the diameter is relatively greater than with long ones. With bulls the ratio $\frac{\text{diameter}}{\text{length}}$ is smaller than in heifers and cows of the same age.

(4) The ash content of hair is not constant. It depends on pigmentation, age, sex, and possibly also on feeding.

1012 – **Conformation and its Relations to Milk Producing Capacity in Jersey Cattle** (1). — GOWEN, J. W. (Maine Experiment Station Orono Maine), in *The Journal of Dairy Science*, Vol. III, No. 1, pp. 1-32, tables 723, Bibliogr. of 14 publications, Baltimore. Jan. 1920.

This paper presents a biometrical analysis of the relation of conformation to the milk producing capacity of the Jersey cow. The study is based on the material collected by the American Jersey Cattle Club in its *Registry of Merit* work compiled by R. M. Gow. The mean conformation as measured by score is given for the cow as a whole and for the parts into which it is divided. In this group under investigation the score was 89.848 ± 0.073.

The variation of the different body parts is compared by means ot standard deviation and the coefficient of variation. The most variable part of the body included the eyes, horns and muzzle, and the least variable, the size of the body. Bone material was in general found to vary slightly less than the scores assigned to parts of the body depending chiefly on variations in bone length. The variation of the udder parts was found to beat the lower end of the range of variation of other soft parts of the body Correlation coefficients for milk yield with the conformation as a whole and for the various parts were determined and ranged from — 0.0697 ± 0.0165 to 0.1941 ± 0.0160. Out of the nineteen correlations the total score had the highest correlation with milk yield. The parts of the conformation having a distinctly significant relation to milk production of the cow were the milk veins, size and condition of udder, size and shape of rear udder, shape and size of barrel and the general appearance of the cow.

A 7-day test has a correlation coefficient with the year milk yield of the cow of approximately 2 ½ times that of the conformation, as a whole or in part. The short test consequently is superior to the conformation as a guide to milk production.

1013 – **Feeding Experiments with Calves in New Zealand.** — BRUCE, J. L. (Superintendent ot Experimental Farm), in *The New Zealand Journal of Agriculture*, Vol. XX, No. 5 pp. 289-298, figs 10. Wellington, May 20, 1920.

With the object of obtaining reliable data as to what extent supplementary foods (mainly home-grown) can be profitably substituted for milk and whey, a scheme of feeding tests, combined with the best practice in calf-rearing generally, was undertaken at the Ruakura and Weraroa Experimental Farms in 1919. In each case 16 calves were divided into 4 groups of 4 each and fed strictly on the respective dietary assigned to each group for 17 weeks. The results were satisfactory ; there have been no deaths, and the calves are in excellent health.

At Ruakura, the calves comprised 12 Shorthorns, 4 Shorthorn × Jersey crossbreds ; at Weraroa the calves used were crossbreds comprising Fresian × Jersey, Shorthorn × Jersey, Ayrshire × Jersey, Fresian × Shorthorn, Guernsey × Jersey and also grade Jerseys.

The substitute feeds at Ruakura were prepared as follows :

(1) See *R.* Feb. 1917, No. 167 ; and *R.*, April 1917, No. 346.

Group I :— Whole linseed flour soaked overnight in water and boiled for 20 minutes next day ; flour mixed with a little water and added 5 minutes before boiling is completed.

Group II :— Boiling water added to linseed meal and bean meal, the whole covered up for 24 hours.

Group III :— Oat meal, and crushed linseed made into porridge and mixed hot with skim-milk.

Group IV :— Dry crushed linseed stirred into the skim-milk immediately before feeding.

TABLE I. — *Results of Feeding Tests at Ruakura.*

Group	Feeding formula per head per day	Weights and gains		Cost of food per head
			lb.	£. s. d.
I	For 2 weeks :	Total first weight	301	1 14 11
	Whole milk . . . . . 8 lb.	Total final weight	1071	
	For 15 weeks :	Total gain	770	
	Whole linseed . . . . 8 oz.	Average daily gain per calf.	1.61	
	Flour . . . . . 2 oz.			
	Skimmed milk . . . . 15 lb.			
II	For 2 weeks :	Total first weight	302	1 8 1
	Whole milk . . . . . 8 lb.	Total final weight	952	
	For 2 weeks :	Total gain	650	
	Linseed meal . . . . 7½ oz.	Average daily gain per calf.	1.36	
	Bean meal . . . . . 12 oz.			
	Skimmed milk . . . . 8 lb.			
	For 13 weeks :			
	Ditto minus skimmed milk . .			
III	For 2 weeks :	Total first weight	303	1 19 6½
	Whole milk . . . . . 8 lb.	Total final weight	1036	
	For 15 weeks :	Total gain	733	
	Oatmeal . . . . . 8 oz.	Average daily gain per calf .	1.54	
	Crushed linseed . . . 9 oz.			
	Skimmed milk . . . . 15 lb.			
IV	For 2 weeks :	Total first weight	301	1 14 7
	Whole milk . . . . . 8 lb.	Total final weight	1148	
	For 15 weeks :	Total gain	847	
	Crushed linseed . . . 9 oz.	Average daily gain per calf.	1.77	
	Skimmed milk . . . . 15 lb.			

From the foregoing Table it is evident that the dry crushed linseed added to skimmed milk gave the highest daily increase in weight. A con-

siderable amount of difficulty was experienced in getting the calves to take bean and linseed meals (Gr. II), but it was found that after 24 hours the food had a sour smell.

The substitute feed at Weraroa was prepared as follows:—

Group I. — Linseed soaked overnight in 2 ¼ pints of water, boiled next day for 20 minutes, adding flour (previously mixed to a smooth paste with cold water), 5 minutes before boiling is completed.

Group II. — Crushed oats fed dry.

Group III. — Linseed boiled to a jelly in water.

TABLE II. — *Results of Feeding Tests at Weraroa.*

Group	Feeding formula per head per day	Weights and gains		Cost of food per head
			lb.	£ s d
I	For 2 weeks:			
	Whole milk . . . . . 8 lb.	Total final weight (17 weeks).	979	17 3 ½
	For 7 weeks:			
	Skimmed milk . . . . 16 lb.	Total gain	718	
	For 18 weeks:			
	Flour . . . . . 4 oz.	Average daily gain per calf .	1.5	
	Linseed meal . . . . 3 oz.			
			lb.	£ s d
II	For 2 weeks:			
	Whole milk . . . . . 8 lb.	Total final weight	1102	19 10½
	For 2 weeks:			
	Skimmed milk . . . 16 lb.	Total gain	822	
	For 13 weeks:			
	Crushed oats . . . . 1 lb.	Average daily gain per calf.	1.7	
			lb.	£ s d
III	For 2 weeks:			
	Whole milk. . . . . 8 lb.	Total final weight	1032	1 7 3
	For 15 weeks:			
	Skimmed milk . . . 16 lb.	Total gain	770	
	Linseed gruel . . . 1 qt.	Average daily gain per calf .	1.6	
			lb.	£ s d
IV	For 1 week:			
	Whole milk . . . . 8 ½ lb.	Total final weight	1355	18 10
	For 1 week:			
	Skimmed milk . . 16 lb.	Total gain	1077	
	For 15 weeks:			
	Bean meal . . . . 8 oz.			
	Linseed meal . . . 6 oz.	Average daily gain per calf .	2.3	
	Warm water . . . 3 qt.			

Group IV. — Boiling water added to linseed meal, plus bean meal, the whole mixed and covered for 24 hours.

From these results, the author concludes that the most important and essential factors in calf rearing (apart from the diet) are : a clean new grass paddock ; a good supply of fresh drinking water ; clean feeding utensils. There is no doubt that the absence of scour among the calves was largely due to the latter precaution.

1014 – **Notes on Breeding Wool-Producing Sheep in Madagascar.** — CAROUGEEN (Chef du Service vétérinaire), in *Bulletin économique de Madagascar*, Year XVII, Nos. 1 and 2 (Ist. and 2 nd, half-years of 1920), pp. 95-105 + 1 map. Tananarive 1920. SHEEP

Notes assembled by the author whilst passing in review the different experiments that have been made on the introduction of sheep wool-producing sheep into Madagascar, and during his study of the question of establishing and developing this industry in the centre of the island, and in the southern regions of the island which are adapted to it.

In the third part of his article, the author mentions a report by M. ROQUETTE, Veterinary Surgeon, which shows that the extreme south of Madagascar is an excellent region for sheep-breeding. . There exists in this zone, a fat-tailed, woolless breed that is perfectly acclimatized and capable of rapid improvement by crossing with wool-producing rams from Europe. The hybrids, after a few generations, have fine fleeces.

In the fourth part of his article, the author describes M. JAUSSAUD'S experiment on the acclimatisation of Craú merinos at Tulear (south-west of Madagascar). This experiment proves that it would be well worth while to raise sheep for the frozen-meat trade (the meat of the crosses is excellent) Sheep, however, only do really well in dry seasons ; in damp, or marshy, places, the mortality among them may be very great.

1015 – **Increase in the Weight and Quantitative and Qualitative Changes in the Wool of Lambs Having Undergone the Operation of Unilateral Thyroidectomy With or Without Castration.** — AGNOLETTI, G. (Istituto di Fisiologia sperimentale della R. Scuola Superiore di Medicina veterinaria, Milan), in *La Clinica veterinaria*, Year XLIII, Nos. 10-11, pp. 245-269, Bibliography of 9 works. Milan, May 31, and June 15, 1920.

With the intention of continuing Prof. PUGLIESE'S studies (*Biochimica e Terapia sperimentali*, Parts 3 to 6) on the correlations between the internal secretary glands and growth phenomena, the author studied the correlations between the testicle and the thyroid and between their behaviour and that of the other endocrinal glands. The author experimented on lambs so as to be able to investigate both the phenomena of growth and those of the nutrition of the wool.

The experiment lasted from June 13,1919, to January 10, 1920, and was made upon 4 lots each containing 2 lambs.

I) Male lamb of the Bergamasque breed ; the right thyroid was removed one week after weaning. Control lamb not operated upon.

II) Lamb of the Valtelin breed ; the rigbt thyroid gland was removed, with castration, 2 weeks after weaning. The control lamb was castrated at the same time.

III) Lamb of the Bergamasque breed ; castrated, with removal of thyroid gland, 5 days after weaning. Control lamb castrated at same time.

IV) Lamb of Bergamasque breed (male) ; Lamb of Bergamasque breed (female).

The results obtained are summarised in the appended Tables.

TABLE I. — *Increase in Weight and Yield of Wool.*

Lots	Treatment	Initial weight	Final weight	Increase in weight in 212 days	Increase %	Wool produced
		kg	kg	kg	%	kg
I	Bergamasque lamb (male) right thyroid gland removed	13.15	23.9	10.4	77.03	0.890
	Control	15	24.6	9.6	64.00	0.730
II	Valtelin lamb: castration and removal of right thyroid	16	28.9	12.9	80.62	1.185
	Castrated Valtelin lamb	18.6	29.7	11.1	59 67	1.000
III	Bergamasque lamb: castration and removal of right thyroid	9.8	22.3	12.5	127.44	0.685
	Castrated Valtelin lamb.	11.6	22.3	10.7	92.24	0.535
IV	Bergamasque ram lamb	19.5	31.5	12.0	61.53	1.265
	Bergamasque ewe lamb	19.5	30.5	11.0	56.41	1.185

As regards increase in live-weight, the lamb which had undergone thyroidectomy was superior to the control lamb by 13.03 % ; the difference was much greater when the animal was also castrated. It is therefore advisable to perform lateral thyroidectomy at the same time as castration, seeing that the former operation involves no risk, gives rise to no disturbances of the system, and induces a larger yield of mutton, without any deterioration in the quality of the meat, and of wool. Though the wool of such animals is not as strong, this is not a defect in the case of this rather coarse type, as it becomes finer and more elastic (which is a great advantage), softer to the touch, and almost as lustrous as silk.

The amount of lanolin was found by the author to be below the normal owing to the fact that the lambs were always kept in a shed and had no exercise, so that they produced but small quantities of this substance.

From his experiments, the author concludes that the testicular hormones have a stimulating effect upon the piliferous system, whereas the action of the thyroidal hormones is just the reverse. Thus, the manes and tails of stallions are much thicker and longer than those of geldings, and the bull has much larger horns than the ox.

Table III shows that, in the case of animals castrated when very young, there is less development of the hypophysis, and that the superrenal capsules must have a great influence upon growth.

TABLE II. — *Characters of the Wool.*

(The 3 numbers of each of the 5 columns refer respectively to the wool of the flank, side, and shoulder.)

Lots	Breed and treatment of lambs	Strength gr.	Elasticity mm.	Diameter μ	Length cm.	Curls. per strand	Lanolin %
I	Bergamasque lamb: thyroid removed .	10–10–11	13–13–13	34–31–31	11 –11.5–11.3	30–32–31	5.7
	Control	11–11–11	9– 9– 9	40–37–37	9 –10 – 9.6	37–34–32	6.8
II	Valtelin: castration and removal of thyroid	20–21–20	15–15–15	43–43–43	14.5–15.3–14.5	43–42–43	6.5
	Castrated Valtelin .	24–24–22	11–13–11	52–49–55	13 –13.5–13.2	32–36–35	6.8
III	Bergamasque castration and removal of thyroid	11–11–11	14–15–13	31–40–37	9.6–10.3–10	35–33–35	7.7
	Castrated Bergamasque	15–15–15	11–11–11	40–46–43	9.2– 9.3– 9.3	30–30–34	8.4
IV	Bergamasque ram lamb	20–21–18	13–12–12	46–47–49	9.7–10.3–10.3	33–34–33	—
	Bergamasque ewe lamb	20–21–20	17–17–16	49–47–47	11.5–11.4–11.5	34–33–34	—

The strength and elasticity are determined 40 tests per sample, the initial tension being 0.2 gm. The length is determined from 25 tests; the number of curls from 20 tests.

TABLE III. — *Weight in grammes of the various organs.*

Lots	Breeds of lambs and treatment	Left thyroid	Right thyroid	Hypophysis	Sur-renal body	Brain	Thymus
I	Bergamasque: thyroid removed	0.977	—	0.037	2.487	80	9.6
	Control	0.932	0.934	0.067	2.824	85	14.0
II	Valterlin: castration and removal of thyroid . . .	1.710	—	0.055	1.907	83	18.5
	Castrated Valtelin. . . .	1.097	1.094	0.060	2.467	80	23.1
III	Bergamasque; castration and removal of thyroid .	0.682	—	0.065	1.537	83	10.2
	Castrated Bergamasque . .	0.572	0.582	0.071	1.501	85	15.1
IV	Bergamasque ram lamb .	0.997	0.999	0.137	2.579	85	—
	Bergamasque ewe lamb .	1.007	0.997	0.107	1.867	80	—

POULTRY

1016 – **Results of the VI and VII Irish Egg Laying Competitions.** — *The Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XIX, No. 1, pp. 25-41, Vol. XX, No. 1, pp 20-38. Dublin 1918 and 1919.

These competitions were conducted by the Department of Agriculture and Technical Instruction for Ireland and were held at the Munster Institute, Cork.

Competition VI. — 1st October 1917 to 31st August, 1918. The following foods were used for the 210 birds entered : — Bran and pollard, 21 ½ cwt — Maize meal, 17 cwt. — Dried grains, 3 cwt. — Dried yeast. 2 ¾ cwt — Palm Nut Meal, 5 ¾ cwt. — Fish Meal, 15 ¼ cwt. — Cracked maize, 10 cwt. — Small wheat, 4 ½ cwt. — Oats. 61 ¼ cwt. — Crushed Oats, 12 ¼ cwt. — Potatoes, 43 ¼ cwt. — Meat Meal, ½ cwt. — Dry Mash, 11 cwt.

The soft mash was fed as usual each afternoon, grain being given in the forenoon, and is the most economical for farm use. The total cost of food for the 4 periods of the competition amounted to £ 161.3s.6d. To this may be added £. 12, the value of grit and cultivated greens used. The average cost per bird is threfore 16s 6d.

The total number and value of eggs from the pens are grouped as follows : White Wyandottes — 1286 — 1256 — 1250 — 1213 — 1208 (6 hens per group). These took the leading place, and were followed by White Leghorns 1174. The two groups lowest on the lists show 760 and 751 for White Wyandottes (Nos. 25, 26 in order of Merit).

Competition VII. — The following foods were used for the 306 competing birds : — Bran and pollard, 2855 lb. — Maize meal, 2888 lb. — Dried grains, 567 lb. — Dried yeast, 578 lb. — Palm nut meal, 39 lb. — Wheat (damaged) 1506. — Oats, 9728 lb. — Barley meal, 1520 lb. — Rice (damaged), 262 lb. — Fish meal, 3142 lb. — Dry Mash 7863 lb. — Potatoes, 564 st. The total cost of food for the four periods amounted to £. 303,17s. including cost for grit, shell, and cultivated greens.

The general results are given and the comparison with former years in tabular form. The winning pen of Wyandottes heads the list with 1359 eggs. The pen of White Leghorns holding third place with a total, of 1347. The last place is occupied by Rhode Island Reds, 776 (No. 36. Order of Merit).

Eleven months ending Aug. 31 st	No. of Pullets	No. of Eggs laid	Average No. of eggs per bird
1913	318	38 199	120.1
1914	282	39 216	139.0
1915	264	39 764	150.6
1916	294	49 830	169.5
1917	210	36 660	174.6
1918	210	36 [illegible]06	171.0
1919	306	55 124	180.0

1017 – **Effects of Feeding Silk-worms on Mulberry Leaves Exposed to the Thick Dust of Main Roads.** — FUSCHINI, C. (Chair of Silkworm-Rearing of the R. Istituto Agrario di Perugia), in *Informazioni seriche*, Year VII, No. 13, p. 198. Rome, July 5, 1920. SERICULTURE

Since 1915, private silk-worm breeders and the members of agricultural institutions have asked the author for his opinion on the subject of planting mulberry trees along main roads, and as to how far the silkworms would suffer should the dust be deposited thickly on the leaves. A first series of experiments had already convinced the author that it was necessary to direct the attention of silk-worm breeders to the bad effects that might be expected if such leaves were fed to the insects ; and now, after 3 years of experimental research on the subject, he has arrived at the following conclusions :—

(1) Mulberry leaves exposed to the thick dust of main roads are injurious, if fed to silkworms.

(2) The injury caused is proportional to the quantity of leaves given and to the amount of dust upon them. The effect of the dusty leaves is to decrease the yield of cocoons (the decrease may be as much as about $\frac{1}{3}$ of the normal production) and to render the quality of the silk inferior, to the extent of causing loss to silkworm breeders and silk-spinners.

(3) These bad effects can, however, be prevented by carefully washing the leaves in ordinary water or by spraying them thoroughly with ordinary water, employing sprayers such as are used for the control of mildew. The leaves should be allowed to dry a little before being given to the silkworms.

(4) The slower somatic growth of larvae fed on dusty leaves appears to be traceable to the imperfect utilisation of the nutritive elements of the leaves, on account of the dust absorbing a certain amount of gastric juice, which is therefore prevented from acting with equal intensity upon the whole contents of the stomach.

(5) Whilst awaiting the results of further experiments dealing with the latter part of the question, the author thinks it well to discourage the plantation of mulberry trees along main roads, especially those frequently used by motor-cars, which owing to their rapid motion, raise great clouds of dust.

1018 – **Training Camels.** — DROANDI, I., in *Agricultura Coloniale*, year XIV, No. 5, pp. 201-218, 1 pl. Florence, May, 1920. VARIOUS ANIMAL

As a general rule, camel-breeders raise the males for work and the females for breeding purposes ; it is only under exceptional conditions that the females are used for beasts of burden, or for riding. Sterile females however, are sent to the butcher's or used for work.

Those Nigerian tribes that employ female camels as mounts are an exception to the rule ; they divide the females into 2 classes : females that have been made sterile (" seiddh "), and females in the fourth to fifth months of gestation (" naya ").

As the female camels habitually enjoy liberty and are well-fed, cases of abortion are reduced to a minimum. The young are suckled under the

most favourable conditions, and as the stallions are chosen with the greatest care, the offspring grow well and their strength is insured.

Male camels are born with the characteristic callosities of the camel, which are in fact *all* congenital, although some writers (H. Wolff, Blachère) regard the sternum callosity alone as congenital.

The young camel is weaned shortly before it is a year old, that is to say, when its mother is again about to be fertilised. From this time, it lives solely on grass. Sometimes camel-breeders collect the yearlings into herds and keep them separate from the herds of the adult camels. At 3 years of age, the young camel is ready to be trained.

There are several breeds of camels, those called " mehara ", and only used for riding (such as the animals raised by the Touaregs and Schiambas), those supplying exclusively beasts of burden, and those that can serve either as pack-camels, or saddle-camels : the best animals are used for the latter purpose, and become " running camels "

The characters distinguishing running camels are : — Very light head, carried high and horizontally; eye large and gentle; long neck; wide, sloping shoulders ; withers high, spare, horizontal, long ; haunches strong, sloping backwards ; legs thin, with prominent tendons and masses of muscle ; thigh wide, flat, long ; hocks low ; perfect balance ; coat white, skin fine ; hair short.

Training only lasts a few months, after which (in countries where it is customary) the camels are generally castrated ; this operation is always advisable, as it renders the animals more elegant and slim in shape. Camels when broken in are gradually accustomed to work.

The first part of the taming process consists in accustoming the young camel to the presence of man, which, however, begins at birth ; in fact, in order to secure part of the camel's milk, the keepers bind some of the teats, or pass a string round the udder. In districts where the attacks of wild beasts are to be expected (e. g., in Erythrea, where hyenas attack the camel, the camels are collected in the evening and to prevent their escaping, their fore-limbs are fettered, and they are forced to lie down.

The second stage of domestication commences by teaching the animal to lie down and rise at the word of command; this is done by taking advantage of the greediness of the camel and tempting him with a handful or fresh grass, barley, or durra. When this is done a long stout rope is fixed to the bar of the camel or to the halter ; the tamer holds the other end of the rope, and leads the animal to places whither it goes unwillingly or with fear, such as the most crowded and noisy parts of the town, beneath trees, on where it is more or less difficult to pass. When the camel has leant to follow his driver readily, to get up and lie down when told, to pass quietly through a crowd, to have no fear of noises, and to remain at a distance from its companions without groaning, it is said to be tamed. The taming process is the same for pack-camels and riding-camels, but the latter have to do all the manœuvres without groaning. On the other hand, the training the camel receives depends on work it has to do.

THE TRAINING OF PACK CAMELS. — When the animal has been tamed in the manner described above, its pack is put on while it is in *decubitus sternal*, and in such as way that it gets accustomed to support the load for some hours. Once this is done, on the following days the camel is made to get up, walk and eat with the pack on its back, and is walked about just in the same mannr as during the first taming-stage. Then, when the caravan starts, the driver's place is taken by an old quiet camel, to whose tail the halter of the young animal is tied ; the first journey is performed with an empty pack. For a good result to be obtained it is best for the caravan to go a long way. When the young camel is used to its pack, and to the discipline of the march, it is first given a light load and afterwards its burden is increased in proportion as it grows stronger.

TRAINING RIDING CAMELS. — The author reproduces the rules, followed by the Touaregs and Meharists of the higher districts quoted by MM. VENEL and BOUCHER in their " *Guide de l'officier mehariste*, and then he describes less gentle and progressive methods employed by the Scherof, Bischiari, and Beni-Amer tribes.

The animal to be trained is provided with a halter which is very tight round its muzzle, so that it can neither open its mouth nor scream. Two ropes are attached to the halter, one on each side ; these are fixed to the ground by means of stakes placed 2 metres apart and this obliges the animal which is kneeling down and unable to move, to keep its head down. The camel remains for 3 days in this position, without eating or drinking. On the fourth day, it is untied by two men who each take one of the ropes ; the halter is loosened from the muzzle and the animal is given food and water. Then it is led about by the two men and finally taken back to its place to be tied up again. This is done for several days, until the camel is accustomed to be handled, then it is untied for 3 or 4 hours daily and put out to grass, but it is still hobbled. Subsequently, the camel is saddled.

When it is used to the saddle, it is necessary to accustom it to the rider. The camel is held by one man only while the rider mounts ; he remains in the saddle for a longer time each day, and after a few days takes the reins himself ; the reins are the 2 ropes of the halter which always remains tight round the muzzle during exercise. For some time the young camel is guided by 2 reins, but later on only one is used. This single rope is attacked to the left side, and the animal learns to turn to the right or the left, according to the movement of the rider's hand, coupled with a slight pull of the rein. When the training is finished a ring is put into the camel's nose and a thin cord attached to it, this acts as a curb. The camel is not guided by the reins alone, but also by a long curved stick with which it is struck on the neck, but this has no effect if it is often used.

It is only when the camel is quite broken to the saddle, accustomed to obey orders, and no longer thinks of returning to its companions, that it is trained to run. First a well-trained animal must be procured, and the two camels are taught to walk together in step, the young one being led by its driver. Then it is taught to amble along in company with the other camel, the distance being increased every day, and afterwards it is

accustomed to keep up the same pace bearing a rider on its back. Finally it is exercised alone.

The Beni-Amers breed pack-camels almost exclusively ; only very special animals are set apart for riding-purposes, and these have no real training. The young camel is tied behind an old riding-camel, and exercised in running ; then, without further preparation, it is saddled and mounted ; recourse is often had to a stick in order to make it obey. Such a method of training is very faulty it turns out noisy, obstinate beasts that refuse to be separated from their companions, though otherwise these camels have often good points, being well-shaped and strong.

In the Agordat region, the author has nearly always seen the young camel with a rope round its neck ; this rope is attached to the neck of an old camel with an expert rider on its back. The young camel is made to run along tied in this fashion for at least 2 hours for several days. There a child mounts astride on its back, and holds on by the hair of the humps. When the camel has learnt a proper pace and is accustomed to a rider, it is saddled and guided by reins but always in the company of its saddle-companion. Finally a man is substituted for the child, and once in the saddle, he soon teaches the young camel to go alone, to obey, and above all to keep the same even pace.

1019 - **Castration of the Camel.** — DROANDI, I., in *L'Agricultura coloniale*, Year XIV, No. 7, pp. 289-301, figs. 4 Florence, July, 1920.

In the coastal regions of Tripolitania, neither horses nor camels are castrated, and as no care is taken in selecting animals for breeding, these districts possess no special type of camel proper to them. On the other hand, in the Central regions and especially among the Touaregs, castration is much practised, only males with exceptional qualities being kept entire. Therefore, there is a characteristic type of Touareg camel, and these people alone have succeeded in producing the riding-camel or " mehari ".

The author describes the method of castration (extirpation of the testicles) that he saw practised by the Touaregs and gives his opinion as to the best means of performing the operation. He advises the castration of all male camels not required for breeding purposes ; this is best done in the spring, because at that season, the animals are in good condition and not suffering from cold, or tormented by ticks, flies, or other insects. He describes the operation which consists in limited twisting of the seminal cord, and advises that the wounds be stitched.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

1020 - **The Use of Tractors in Cochin-China.** — MAGEN, R., in the *Bulletin de l'Institut scientifique de Saïgon*, Vol. II, No. 8, pp. 225-227. Saïgon, Aug., 1920.

An article by the author has already been published in the *Review* (1). dealing with " Motorculture in the Colonies ". In this article he gives the

(1) See *R.*, June, 1920, No. 685. (*Ed.*)

results of the first agricultural experiments made with the machinery of the Agricultural Section of the Institut Scientifique.

Caterpillar tractors on the rice farms at Nang-Rên. — The work was done at the end of the dry season of 1919-1920, from April 16-30, 1920. The ground was full of cracks, very hard, and covered with rushes and other herbage. With a 3-furrow plough, using a helical mould board, an average depth of 15-20 cm., was worked. The earth was completely turned and all vegetation buried, Using second speed (6 km., per hour(20 ares can be covered per hour, only half the available power being used.

The planters of the region stated that the results were very good both in cultivated land and in virgin soil covered with thick herbage, the herbage being destroyed.

Moreover, the rice crabs and rats are exposed, enabling the coolies to kill them.

The staff of each outfit consisted of the tractor driver, the plough driver and an assistant driver in charge of the hauling.

Tractor with two driving wheels. — Very good results have been obtained in the western rice fields (at Soctrang) with the tractor having two driving wheels and a plough with a cylindrical mould-board. The work is much better than that done by natives; mechanical cultivation is certainly worth while; the chief difficulty to be overcome is the grip on the soil, which though almost perfect on ground lightly covered with vegetation, when the ground is bare, wet, and stiff, conical grips should be fixed on to the wheels.

The working speed during ploughing was 1.5 to 1.0 km., per hour, the depth maintained was 8 to 10 cm., and the petrol consumption was 5 to 6 litres per hour.

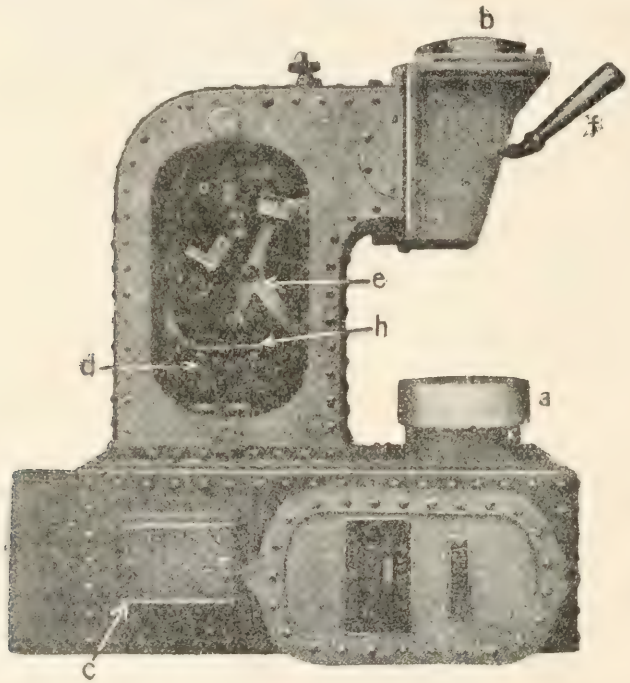
Banking up rice. — The method employed for banking-up rice is to turn up the humus and herbage over a track 2.60 metres in width with a tractor hauled plough, then to ridge up the clay sub-soil with a simple Brabant plough with a helical mould-board, otherwise the furrow will not be deep enough. The earth is now in fair clods ready for the final work, which is done by the coolies.

Various trials of tractors. — Tractors are also used for drawing wagons unloaded or loaded with paddy, or towing boats. The author stated that, the rainy season having started, these tractors continued to work in 30 cm. of water.

1021 – **Automatic Weighing and Felling Machine.** — BERTARELLI, E., in the *I. I. I. Rassegna della produzione italiana, Numero specialmente dedicato all'Agricoltura all'Alimentazione ed alle Industrie derivanti*, Vol. IV, Sect. D. No. 6, p. 29, figs 2. Milan, June, 1920.

The determination of the weight of food products packed in boxes, bottles etc., and sold according to a declared weight is usually performed mechanically by fillers which measure volume and not weight. Thus, errors constantly occur, due to temperature, climatic conditions, etc. In the present article, a weighing and filling machine, to overcome these difficulties, designed by M. G. CERLINI of Parma, is described.

The machine consists of a movable stand *a* which acts as a weighbridge on which the box or boxes are put ; above it is a hopper *b* made of acid-proof bronze. The weighbridge is adjustable to the desired weight and as soon as the correct amount of produce has been fed from the hopper into the box below. the weighbridge *a* tilts and in so doing the revolving axle closes an electric circuit, through the switch box at *c*.



The closure of the circuit brings into action an electro-magnet *d* which attracts the metal rod *h* and releases at once the bell-crank which in turn operates on a spring catch which causes a double valve to fall, like a guillotine, across the mouth of the hopper, thus stopping the fede at once. A switch (*f*) cuts off the current, the machine returns to normal, and is again ready for use.

The amount of electric current required is very small and the machine reduces manual labour to a minimum.

FARM BUILDINGS

1022 – **Construction and Fire Protection of Cotton Warehouses.** — WORKMAN, J. M., in the *United States Department of Agriculture, Bulletin* N°. 801, pp 1-79, Pl. 34, plans 7, Washington, 15 Dec. 1919.

The article includes the primary factors in warehouse design, and gives instructive details of the fire-resistive, slow burning, semi-slow burning, frame and iron-clad constructions now in use in the cotton warehouses in the United States. Useful plans are given illustrating the various construc-

tions as a basis for warehouse planning, and plates indicate the degree of success with which certain types have withstood the tests of fire.

Fire resistive construction is advised for warehouses several stories high, but the slow burning construction is sufficient for a single story warehouse.

An inexpensive method suggested of securing protection from exterior exposures is to use masonry for the exposed walls, and frame construction for walls not exposed.

RURAL ECONOMICS

1023 - **The Cost of a Vineyard in 1920 in Certain Regions of France.** — CHAROULET, A., in *La Feuille vinicole de la Gironde*, Year LXV, No. 9, p. 1, March 4; No. 10, p. 2, March 11; No. 17, p. 2, April 29. Bordeaux, 1920.

In the Libournais district. — In this article M. CHAROULET discusses the cost of a hectare of vineyard three years old, the cost of upkeep during the years following, and the yield.

First year	Fr.	
Per hectare of fallow or under cereals	8 000.00	
Digging up before planting	3 500.00	
Manuring (night-soil of farmyard manure)	1 500.00	
Superphosphate: 800 kg., at 30 fr., per 100 kg.	240.00	
Plants: 5 400 at 80 fr. per 100	4 320.00	
Planting	600.00	
Weeding and labour	200.00	
3 sulphate sprays and labour	80.00	
		18 440.00
Interest on 18 440 fr., at 6 %		1 106.00
Total cost per hectare		19 546.00

Second year	Fr.	
Carried forward	19 546.00	
Preparation	450.00	
Sulphating and sulphuring	250.00	
Replacement of 1/20 of non-sprouters, 270 plants at 80 fr., per 100	216.00	
Labour for replacing plants	24.00	
Interest on 19 546 fr., at 6 %	1 172.00	
Total cost per hectare at end of second year		21 658.00

Third year	Fr.
Carried forward	21 658.00
Preparation	450.00
Replacements	80.00
Staking: 5 400 stakes at 400 fr. per 1 000	2 160.00
Iron wire. 3 rows No. 15, 480 kg., per hectare at 180 fr., per 100 kg.	864.00
Pointing, stringing, supporting	250.00
Willows for arching, labour	30.00
Labour on stringing and wiring	250.00

Four sulphatings :			
Spray mixture	495.00		
Labour	320.00		
		815.00	
Three sulphurings, sulphur, labour		130.00	
Interest on 21 658 fr. at 6 %		1 300.00	
Total cost at end of third year			27 987.00
Deduct : net gain 10 casks at 300 fr., per cask			3 000.00
Balance			24 987.00

Thus one hectare of vineyard cost, by the end of the third year, 24.987 fr., so that amount cultivated by the farmer, namely, five hectares has cost 124 935 fr.

Expenses per year from the 4th year	Fr.
Replacements of dead plants	200.00
Feed for one horse or ox	3 000.00
Preparation	2 500.00
Sulphating :	
120 barrels at 5 kg. = 600 kg., sulphate at 190 fr., per 100 kg.	1 149.00
300 kg., lime at 30 fr., per 100 kg.	90.00
Labour : 5 fr., per cask	600.00
Sulphur sprays :	
400 kg., sulphur at 110 fr., per kg.	440.00
Labour	100.00
Replacement of stakes, etc.	200.00
Harness, shoeing etc.	600.00
Rushes : 20 trusses at 2.50 fr.	50.00
Superphosphate 600 kg., to the hectare, i. e. 3,000 kg., at 27 fr. per 100 kg.	810.00
Manuring, etc.	500.00
Vintage : 25 fr., per cask	2 250.00
Two drawings (delivery March)	180.00
Taxes, Insurance, accidents, hail, etc.	2 000.00
Interest on 124 935 fr., at 6 %	7 496.00
	22 156.00

The minimum expenses in the fourth and following years average, is then 22 156 fr. per annum, exclusive of the owner's time given to management.

The average yield of 5 hectares is 90 casks, which at 300 fr., per cask totals 27,000 fr., and at 400 fr., per cask totals 36 000 fr. Thus by selling at 400 fr., the cask, a gross profit of 13 844 fr., is made. Apart from the average net profit, account must be taken of sprays, casks, utensils, packing, transport, loss, disease, etc. which is by no means small.

In 1917-18-19 those who did not suffer from hailstorms notably benefited, but they had suffered badly before from long periods of oidium, phylloxera, mildew, black-rot, frosts, hailstorms, trade depression, etc.

The following table shows the increase in the working expenses of the vine growers from 1914-1919.

	1914	1919		1914	1919
Manual labour per day	3	10	Horse	1 000	4 000
Cost of ploughing per day	8	25	Cart	400	2 000
100 kg., sulphur	18	120	Pig, per 100 kilos	120	1 100
100 kg., copper sulphate	50	185	Boots	20	80
Iron sulphate	5	25	Clothes	100	400
Rushes	0.75	2.50	Meat (per pound)	1	4
Willows	4	20	Superphosphate (100 kg.)	6	27
Fodder	12	80	Sabots	125	10
Straw	7	40	Oxen	600	4 000
Plants, per thousand	60	800	Casks	14	180

In Blayais. — The cost of vine-growing over an area of about 11 hectares worked by three vine-growers, living with their wives on the property, and having a horse and wagons:—

Cost in 1914.

Cultivation (pruning, training, etc.);
Two hoeings and twice ridging;
Two hoeings;
Raising, thinning out and topping;
Four sulphatings;
Three sulphurings.

At 75 fr., per day	2 250.00	Fr.
Cost of 500 kg. of copper sulphate at 60 fr., per 100 kg.	300.00	
Cost of 1000 kg., of sulphur at 20 fr., per 100 kg.	200.00	
Cost of manure, fertilisers, rushes, willows	400.00	
Vintage, 20 cutters and 10 men for 15 days, food included	2 000.00	
Horse feed at 2 fr., per diem for 365 days	730.00	
Wine given to the vine growers, 2 casks per family (3 families) 6 casks at 70 fr., per cask	420.00	
Repairs and upkeep	300.00	
Taxes and insurance	400.00	
Rent of vineyard or interest on capital: 60 000 fr. at 5 %	3 000.00	
Total	10 000.00	

Cost in 1920.

Cultivation (pruning, training, etc.);
Two hoeings and ridging twice;
Two hoeings;
Raising, thinning out and topping;
Four sulphatings.

At 250 fr. per day	7 500.00	Fr.
Cost of 500 kg., of copper sulphate at 60 fr., per 100 kg.	850.00	
Cost of 1000 kg., of sulphur at 20 fr., per 100 kg.	1 000.00	
Cost of manure, fertiliser, rushes, willows	1 200.00	
Vintage time, 20 cutters and 10 labourers for 15 days feeding included	5 000.00	
Horse feed at 10 fr., per diem for 365 days	3 650.00	
Wine given to the growers: 1/4 cask per diem at 300 fr., per cask, 7 1/2 casks	2 250.00	
Repairs and upkeep	1 000.00	
Taxes and insurance	500.00	
Rent of vineyard or interest on capital: 120 000 fr., at 6 %	7 200.00	
Total	30 150.00	

The Vineyards of Burgundy (Côte de Beaune). — The vineyards of Burgundy generally are very much subdivided and there are very few homesteads and vineyards combined, so that advantages such as exist on large farms are rare. The owners of these small vineyards do most of their own work, and during the busy season obtain help from those whose vineyards are not big enough to demand their whole attention. The cultivation of these small holdings is certainly the most advantageous ; there is no great expenditure of money, and it is to the direct interest of the grower to obtain the maximum yield at the minimum cost. The large properties are put either into the hands of middlemen, or kept under direct management which, although more troublesome, gives better results. In order to obtain a good idea of the cost of working a 10-hectare vineyard all the various factors concerned in its maintenance must be consider d.

If it is admitted that the vineyard has a life of about 30 years, 33 ares must be reconstituted annually, 1 hectare of 1, 2, and 3 year-old vines, is not in bearing, 8 hectares are yielding and 67 ares are resting.

Reconstruction. — This entails the following expenses :

	Fr.	Fr.
Digging up : 33 ares at 1000 fr., per hectare		330.00
Grafts : 3300 grafts for 33 ares at 600 fr., per 1000		1 980.00
Staking : 560 stakes at 0.75 fr., each	420.00	
Iron wire : 300 kg., at 2.00 fr., per kg.	600.00	
		1 020.00
Manual labour for 8 days at 12.50 fr., per diem		100.00
Total cost of 33 ares,		3 430.00
Cost of 1 hectare roughly		10.000.00

Exploitation. — The " pinot " vines of *Bourgogne* need particular attention because of the nature of the variety, the climate and the quantity of the product.

Pruning starts with the first fine days in February, followed by tillage (3 or 4 times per year), training, which is done by removing the shoots growing on old wood, tying up, and topping. Next comes spraying with copper sulphate and manuring.

The cost of the 9 productive and non-productive hectares are as follows :

		Fr.
Pruning		1 625.00
Cultivation ; going over by hand 4 times		2 550.00
Cultivation ; ploughing four times		2 880.00
Training ; female labour		880.00
Tying and topping ; female labour		1 440.00
Sulphuring ; manual labour, 2 treatments		375.00
Sulphur ; 50 kg., per hectare at about 100 fr., per kg.		500.00
Sulphating ; manual labour, 3 treatments		1 050.00
Sulphate, 500 kg., at 200 fr.	1 000.00	
Lime or sulphur, 330 kg., at 30 fr.	100.00	
		1 100.00
Manures, fertilisers, 1/4 manuring		1 800.00
Transport of materials, manure, etc		1 000.00
Total cost for 9 hectares		15 200.00
Cost per hectare		1 700.00

The figures just stated are purely theoretical, and in practice they should be increased by at least 1/3 and, because of the scarcity of labour, the staff must be kept at full strength during the slack season, when only odd-jobs can be done. Nor has the cost of repairs to the tools, sprayers, and wagons, or the insurance taxes, or general treatment been included.

In short, it may be stated that the total cost per hectare is as follows:

	Fr.
I. — Cost of reconstruction (theoretical)	10 000
Increased by 1/3	3 300
Total	13 300
	Fr.
II. — Cost of exploitation	1 700
Increased by 1/3	560
Total	2 260
	Fr.
III. — Interest on Capital at 5 %	1 000

The value of the land for money interest and amortisation of the invested capital is calculated on an average of 20,000 fr., per vineyard of the best vintages, a value exceeded in the past but not guaranteed to day for an immediate liquidation.

The yield of the large Burgundy vineyards under favourable circumstances hardly ever averages more than 13 hectolitres of wine per hectare.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1024 – **Detection of Cider in Wine.** — Garino-Canina (R. Stazione enologica sperimentale d'Asti), in the *Giornale vinicolo italiano*, Year XLVI, Nos. 20-21, pp. 164-166. Casale Monferrato, June 6, 1920.

The author first briefly treats of the physiological and diagnostic properties of the gummy, pectic substances common to all fermented beverages, and in order to show how the presence of cider may be detected in wine, he describes the methods used by Scurti, A. Müntz and E. Laine for determining them. Afterwards he gives the data of his analyses of both grape and apple musts.

Table I. — *Analyses of grape musts.*

	Alcohol	Dry Extract	Gummy and pectic substances
Favorita must 1919	—	24.00	0.80
Ordinary red wine 1919	11.50	23.40	1.94
» » of the south 1919	13.00	27.00	3.84
Old red wine 1915	10.25	21.00	1.85
Fine red wine (Barbera) 1919	12.25	25.00	1.91
Dry white wine. 1919	11.75	20.00	1.75
Sweet » » 1919	6.25	26.00	2.58
Red Piquette	7.30	12.50	1.40

Table II gives the composition of sweet and of acid apple must obtained from 10 kg., of apples that were cut into quarters, left to stand for 24 hours, and then well pounded with a wooden pestle before being pressed.

TABLE II. — *Analysis of apple must.*

Density of must at $^{15}/_{15}$	1.0466	Total acidity in cc. N/1 per 1000	73.50
Reducing sugars gm., per 1000	83.20	Combined acidity per 1000	23.00
Saccarose	12.40	Total tartric acid	0.00
Extract	30.00	» malic »	90.20
Extract, sugars deducted	125.00	» tannic »	0.30
Pectic substances	0.990	Total nitrogen (N)	0.112
Ash	2.40	Total phosphorus (PO^4)	0.100

A certain portion of this must, after being thoroughly sterilised, was sown with yeast that had been selected for Champagne, on November, 23, 1919; 12 days later it was filtered once, and on analysis, gave the results set forth in Table III.

It is not possible to make a serious comparison based on the pectic and gummy substances alone, for as may be seen, they are present in very small quantities. Tartaric acid, though not occurring naturally in apple-must, may have been added, by way of adulteration, and the saccharose afterwards found in apple must becomes inverted later and disappears during the fermentation process.

Density of cider at $^{15}/_{15}$	0.9993	Total acidity in cc. N/1 per 1000	80
» » distilled cider	0.9915	» volatile acidity	3.65
Residue brought up to volume	1.0084	» combined acidity	27.00
Alcohol in volume %	6	Total tartaric acid	0.00
Extract in gm., per 1000	20.16	» malic »	73.00
Reducing sugars in gm., 1000	0.97	» lactic »	4.60
» » after inversion	1.55	» tannic »	0.25
Dry extract in gm., per 1000	18.61	» succinic »	7.80
Pectic substances	0.960	Total nitrogen (N)	0.0999
Ash in gm., per 1000	2.15	Total phosphorus (PO^4)	0.100

The author thinks that the best method to adopt in these investigations is the one used by MM. MEDINGEN and MICHEL; 15 cc. of wine are tested by adding a concentrated solution of nitrates of sodium and potassium. If there is cider present, the liquid assumes a colour varying from dark-green to blackish-brown, and after a short time, blackish flashes appear; these are insoluble in water and alcohol but soluble in alkalis, in which they produce a red coloration.

In white wines made from grapes, this treatment gives rise to a coloration varying from orange-yellow to dark-yellow, but no precipitate is formed. Sulphurous acid retards the reaction, which, however, appears more clearly after a certain time. Pasteurisation is without any effect.

This test is less decisive in the case of red wines, owing to the colouring matter present, which on being acted upon by strong acid, makes the wine turbid, and produces a brown deposit, thus masking the colour reaction to a large extent.

1025 – **Cider from Wild Apples of Tran-Ninh (Laos Indo-China).** — See No. 989 of this *Review*.

1026 – **The Use of Rice in Distilling and Brewing.** — SAMUEL, M. (Chef de fabrication à la Société Française des Distilleries d'Indochine), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 4, pp. 109-116, plates 2. Saïgon, April, 1920.

In those countries of the Far East where rice is grown, this cereal is used as raw material for the manufacture of alcoholic beverages, especially brandy, saké (Japanese beer), choum-choum (Indo-Chinese brandy) etc. European manufacturers have installed themselves side by side with native producers, whose methods are always of an empirical nature.

The author makes a comparative study of the native methods and modern methods. He also studies the products obtained by both: — Alcohol and its by-products (rice-vinegar, acetone, and butyl alcohol), and discusses the question of using rice in brewing pale ales. The rice is employed as a substitute for malt, and sometimes replaces it to the extent of nearly 30 %.

1027 – **Beet Syrup.** — GRÉGOIRE, A. (Directeur de la Station de Chimie et de Physique agricoles de Gembloux), in *Annales de Gembloux*, Year 26, Part 6, pp. 265-271. Brussels, June, 1920.

The author advocates a more extensive use of beet syrup, which is a very nutritive, tasty, wholesome and economical article of food. It would be possible, with suitable methods, to obtain 12 000 kg., of syrup per hectare of beets. At first the slightly bitter taste of the syrup is not very agreeable, but persons soon get accustomed to it.

The manufacture of beet syrup is not a new thing, it has long been made in those districts where apple syrup is used and is employed as a substitute for the latter. This is especially the case in the Province of Liège and in Westphalia, but as a rule it has remained a small industry that is little studied, and badly provided with apparatus.

The syrup factories at present use the sugar beet, which, in the author's opinion, is a great mistake as the raw material should consist of the semi-sugar beet, which has a high yield and produces a non-crystallisable syrup containing many impurities, especially pectic substances that give its special character to the product and at the same time, increase the output. Further the semi-sugar beet furnishes more than twice as much pulp per unit of surface than the sugar-beet, and its pulp, which is easily dried, is an excellent stock feed.

In making the syrup, it is necessary as far as possible, to prevent the cell contents (probably albumen) from finding their way into the syrup, as they impart to it a bitter flavour. In order to obtain syrups rich in pectic

substances, the beets must be boiled and the juice extracted by pressure.

Two processes are used. In one, the beets after being well cleaned, are cooked in a small quantity of water, then cut into pieces by a machine, and the mass is finally passed through the press. In the other, the roots are cut up into long narrow pieces or thin slices which are then boiled in water and subjected to pressure. The author remarks that the second process is probably preferable from the point of view of the quality of the product.

In the experiments it was found that by a second treatment of the residue of the first pressing and the addition of the juice from the first boiling, the yield of raw material is increased about 2.5 %. If this method is adopted, it is clear that the second extraction mentioned above will give a better result, and less of the cell contents will pass into the juice.

With a view to leaving behind in the pulp the nitrogenous substances causing the bitterness of the syrup, the author suggests trying the method employed by STEFFEN in sugar-making, that is to say, to allow the pieces or thin slices to fall directly into the boiling juice as they leave the rootcutter. In this manner the nitrogenous substances coagulate better.

With regard to a press, a hydraulic press, or one of the automatic mechanical presses now used for grapes can be employed.

In order to obtain a really fine product, the juice obtained should be purified in order to remove the pulp fragments, a small quantity of which is sometimes present, and also such soil as has not been completely washed off the roots. For this purpose a continuous centrifugal machine of the type of the BOURGMEISTER and WAIN cream-separators might be tried.

The juice should be evaporated by direct heating. This slight caramelling produced under these conditions is necessary to give the syrup its characteristic taste and aroma. A triple effect evaporator would perhaps give a product of better appearance, but less tasty. But the impure liquid is very effervescent, and treatment in a triple effect evaporator is not without difficulties.

In his experiments, the author used an apparatus calculated to hasten evaporation, while keeping the temperature of the liquid lower. At the same time, effervescence was prevented. This apparatus, of which the object was to increase the evaporating surface, was simply composed of an endless chain made of sheet-iron plates united by rings. The chain was mounted on a drum rotated by a handle, the free end being plunged into the liquid. Evaporation, when effected in this manner, takes less time, and the quality of the syrup is greatly improved.

The yield of syrup naturally varies with the quality of the beets used, the way they are treated, and also the concentration of the final product. It may be as much as 17 % of the raw material.

The syrup is put into little bowls, or earthenware pots. If sufficiently concentrated, it keeps indefinitely and even improves with age.

1028 – **Maize Sugar** (1). — VIEILLARD, P. (Directeur du Laboratoire de Génétique de l'Institut Scientifique de l'Indochine) and TRAN-VAN-HUU (Assistant at the Same Laboratory), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 4, pp. 106-108. Saïgon, April, 1920.

The question of maize sugar has been studied since the beginning of the twentielth century in the United States, and it has also been investigated in India and South Africa. The preliminary experiments carried out in these countiries have shown that simply by removing the female ears at the moment when the seeds are about to become milky, the stem becomes full of sweet sap containing from 9 to 14 % of sugar, though normally there is but very little glucose and no saccharose in the stem of the maize.

The authors have made experiments which confirm these data. They consider that the sugar represents the reserve products elaborated by the plant, and that the removal of the ears prevents the sugar being transformed into starch in the grain.

The author's experiments were carried out at the Phumy Selection Garden, and were made on maize sown by M. CARLE for selection; therefore, in order not to interfere with his work, only 4 or 5 stems per lot were used. The dates of the removal of the heads and of the harvest were chosen so as to allow from 7 to 34 days' interval, according to the lot, between these operations.

The analyses were made by M. VERNET, Director of the Chemical Laboratory at Saïgon, as soon as possible after the harvest (in the case of lot 3, six days were allowed to elapse between the gathering of the stalks and their being sent for analysis, which would perhaps explain certain anomalies).

The accompanying table which gives the results of the analyses classified in ascending order of the interval between the removal of the heads and harvest, shows that if the maize stem yields much less sugary juice than the sugar-cane (the yield being only 38 to 48 % in the case of the former, as against 80 % in that of the latter) the bagasse contains a very large amount of sugar that could be extracted by maceration or diffusion. The total yield of saccharose, as compared with the weight of the stem stripped of its leaves, varies from 7.25 to 10.27 %, whereas that of the glucose varies from 1.33 to 3.11 %.

If the saccharose were extracted by the ordinary processes employed in sugar-factories, only ⅓ of the amount would be obtained, since the large quantities of ash and glucose present would prevent the crystallisation of the sugar. It is, however, quite possible that new processes could be devised.

Further, these difficulties would not exist, if it were a question of manufacturing alcohol; for this purpose, the total sugar content, saccharose + glucose would alone have to be considered.

The total sugar obtained by the authors from the fifth lot amounted to 13.38 % of the weight of the stems. It may be that the optimum

(1) See *R.*, Dec., 1914, No. 1104 and *R.*, May, 1915, No. 540. (*Ed.*)

interval between the removal of the female heads and the harvest is longer than 34 days, and that a still larger yield might be obtained by prolonging it. The authors intend to continue their experiments.

Results of the Analysis.

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Name of Variety	Kontum	Kontum	Saïgon	Saïgon	Gelemenado
Date of sowing	20/11/19	20/11/19	25/10/19	25/10/19	28/10/19
Date of rémoval of ears	29/1/20	29/1/20	7/1/20	7/1/20	6/1/20
Number of days between Sowing and harvest	77	84	93	100	103
Number of days between Removal of ears and harvest.	7	14	19	26	34
Study of the stem.					
Average weight of stripped stem	0.322	0.295	0.356	0.463	0.335
Average weight of leaves.	0.428	0.165	0.105	0.240	0.295
Proportion of weight of leaves to total weight %	56	36	23	34	47
Weight of sap extracted %	38.02	35.77	33.84	48.73	38.45
Weight of bagasse %	61.98	64.23	66.16	51.27	61.55
Loss of weight of bagasse at 109° %	66	58	65	52	64
Study of sap					
Density brought up 15°	1054	1058	1061	1062	1069
Dry extract %	13.23	14.04	—	15.08	16.61
Ash %	0.97	1.276	—	1.22	2.276
Saccharose %	9.11	9.84	8.75	10.32	11.97
Glucose %	2.25	1.68	1.62	2.03	3.63
Glucose coefficient	24.73	17.11	18.55	19.67	30.36
Quotient of purity	68.85	67.67	56.81	68.43	72.18
Sugars calculated in proportion to the weight of the stems					
Saccharose in the extracted sap %	3.46	3.52	2.96	5.02	4.60
Saccharose remaining in the bagasse %	3.79	4.28	4.45	3.13	5.67
Saccharose Total %	7.25	7.80	7.41	8.15	10.27
Glucose in the extracted sap %	0.85	0.60	0.55	0.99	1.39
Glucose remaining in the refuse %	0.94	0.73	0.82	0.61	1.72
Glucose Total %	1.79	1.33	1.37	1.60	3.11
Total sugar %	9.04	9.13	8.78	9.75	13.38
Theoretical yield of alcohol at 100° %.	5.51	5.58	5.36	5.95	8.16

In plantations supplying a factory where sugar, and alcohol are both made, experiments in growing sugar-maize, should be made, if only with a view to using the distillery plant during the dead season. In Cochin-China, maize is sown, according to the districts, either in November and December, or in April and May. The sugar-maize would therefore be harvested in February and March and in July and August, and as the sugar-canes are gathered from November to February, the two maize crops could be intercalated in the period when the sugar-canes are left to rest.

Although it is difficult to estimate *a priori* the alcohol yield of maize per hectare, at least 20 000 kg., of stripped stems can be reckoned per hectare, and taking the average sugar yield at 10 % of this weight, we should have 2 000 kg., of sugar or 1 000 kg., of alcohol at 100°, allowing for losses.

These yields could be greatly increased by improved cultural methods and the use of fertilisers. It most also be taken remembered that, though they seem small in comparison with the yield of the sugar-cane, these returns are obtained 100 days after the maize is sown, whereas the sugar-cane is only ripe, at the earliest, 8 months after the cuttings are planted out.

1029 – **Tunisian Olive Oil; Detection of Tea Oil in Olive Oil.** — I. Dybowsky, J. and II. Millian, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 23, pp. 577-581. Paris, June 16, 1920.

I. — The olive tree was not grown at all in Tunis before that country became a French Protectorate. Since then, the French, inspired by the work of the ancient Romans, have popularised the olive industry, which has become of very great importance.

Large areas of land sold by the Administration of Agriculture at 10 francs per hectare, on the sole condition that 10 olive trees should be planted, have become valuable beyond the most sanguine expectations. With the expenditure of a few hundred francs, a hectare was planted with 18 olive trees, which it supported till the time of bearing. The foliage of the trees was very fine, and the average yield amounted to from 8 to 10 litres per tree.

At the present time, as prices have risen to 6 and 7 fr. per litre, each tree is worth several hundred francs, The olive groves of the south have acquired a value that exceeds the most optimistic previsions.

There is still unoccupied ground, where more olive-trees could be planted.

In 1917, Tunis produced 24 400 000 litres of oil; in 1919, 21 433 000 litres: this includes olive-oil of first quality and oil from olive-pomace.

As all matters relating to this industry are of great interest, M. Dybowsky made a communication to M. Millian on the subject of the adulteration of olive oil by the addition of tea oil, which is said to be practised in England.

Care must be taken in France to prevent the olive-oil from French North Africa from being tampered with, lest it should lose its well-deserved reputation. The following is a summary of the communication in question.

II. — The adulteration of olive oil with tea oil, which greatly resembles the former in its physical and chemical characters, has been greatly facilitated by the progress made in industrial rectification and deodorisation, and much encouraged by the high price commanded by olive oil. Of the various methods of detecting this fraud, 3 alone are worth mentioning :

(1) 50 % *Mixture.* — The difference in the fatty acid content permits of the detection of the addition of 50 % or more of tea oil (this is not a very reliable method, as the fatty acid content of olive-oil itself is not invariable).

(2) 10-20 % *Mixture.* — *Action of nitrous fumes.* — Test-tube 2.5 cm. in diameter ; 20 gm. oil ; 6 drops sulphuric acid at 66° C. ; shake for a minute ; 9 drops nitric acid at 40° C. ; shake for a minute ; plunge the tube into boiling water for 5 minutes ; put the tube into a cold bath at from 8 to 10° C. Examine the contents after 2 hours. The most interesting results are as follows :

(*a*) Isometry is complete with 20 % mixture, and the mass remains entirely liquid.

(*b*) If 10 % of tea oil is added, the mixture solidifies, but the mass has not the consistency and hardness obtained with pure olive oil.

(3) 5 % *Mixture.* — *Characteristic Reaction.* — This is obtained by using the old method adopted by CAILLETET : 5 cc. of pure sulphuric acid at 66° C. ; 3 cc. nitric acid at 40° C. ; 3 cc. water ; shake vigorously to mix ; add 4 cc. oil ; shake for 30 seconds ; plunge the test tube into water at 5° C. for 5 minutes ; leave standing in water for 15 minutes and then examine :

Name of oils	Oily stratium	Acid stratum
Pure olive oils	Straw-colour, clear	Colourless
Pure tea oil	Sooty-black, turbid	Do
Olive oil 90, tea oil 10 %	Dirty dark chestnut	Do
Olive oil 95, tea oil 5 %	Dark straw-colour, turbid	Do

By this method, all commercial quantities of tea oil in olive oil can be rapidly and surely detected.

1030 – **The Distillation of *Blumea balsamifera* (Camphreaceae).** — BUSSY, P. (Chimiste principal du Laboratoire de Chimie de l'Institut Scientifique de l'Indochine), in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, No. 6, pp. 181-182. Saigon, June, 1920.

The apparatus used by the author for distilling this plant, and which was made in the above-mentioned laboratory, only differs from the ordinary still in the form of its condenser ; this consists of the following parts :

(1) An external cylinder of about 1 metre in height, and with an external diameter of 30 cm. It has a double wall, the cold water circulating in the space between the walls ; this cylinder is provided at the ends

with conical detachable bottoms forming hydraulic joints ; both are supplied with two tubes for attaching to the water supply.

(2) A cylinder 15 cm. in diameter, in which cold water also circulates ; this cylinder, which is placed inside the other, is surrounded by discs that are incorporated with it ; on these discs are placed covers acting as baffles.

The apparatus is put vertically on a stand and connected with an ordinary still with hydraulic joints.

The object of the discs attached to the central cylinder is to retard the movement of the vapours and to lengthen the time of their passage through the apparatus, thus ensuring more complete condensation.

The camphor sublimes in heating and becomes deposited, owing to the cooling action, on the sides of the centre cylinder and on the first discs.

The essential oil and the water of condensation flow away through the lower tube. These liquids are caught in a Florence flask in which they separate.

The distillation experiment carried out by the author at Nui-Chua-Chang, in the Province of Bienhoa, with this condenser attacked to a DEROY still, gave the following results with fresh leaves :

Weight of fresh leaves distilled	54 kg.
Crystallised camphor obtained	0.250
Essential oil collected	0.025
Camphor yield per 1 000 of fresh leaves	4.63
Yield of essential oil per 1 000 of fresh leaves	0.83

This camphor, which is of laevo-rotatory Borneol, when treated with dilute nitric acid, gave an oxidisation product with the smell of ordinary camphor.

The essential oil is of a fine amber colour. On cooling, it deposits crystallised camphor.

1031 – Concentration of Tobacco Extracts by Freezing. — FERRETTI, U., in the *Rivista del Freddo*. Year VI, No. 3, p. 87. Rome, March. 1920.

The author, quotes the work of PARENTY and MONTI (1) on the concentration of vegetable extracts by freezing; the last-named author has shown the importance of this method to Italian industry; he has invented and patented a rotary concentration, which according to the author, gives much higher yields than those given by the usual system employing ice,

The author advised that the MONTI system should be used for concentrating tobacco extracts by the Italian Department of State monopolies, for, taking into consideration the present price of coal, it is much quicker and cheaper, than concentration by evaporation. With a MONTI direct expansion rotary freezer, 500 kg., of ice is separated per hour from 1000 litres of solution. The MONTI apparatus has been in use at the oenological station at Asti for several years and has been utilised with great success in various industries, e. g., for the concentration of must.

(1) See *R.*, Sept. 1917, No. 857. (*Ed.*)

1032 – **Broom as a Paper Making Material.** — See No. 987 of this *Review*.

1033 – **New Method of Freezing Vulcanisation of Rubber.** — See No. 976 of this *Review*, note (1),

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1034 – **The Development of Acidity in Milk** (1). — STEUART, D. W. (University College. Cardiff, Wales), in *The Journal of Dairy Science*. Vol. III, No. 1, pp. 52-59, Bibliogr, of 7 publications. Baltimore, Jan. 1920.

These experiments were designed by the author to cast some light on the bacteriology of the keeping properties of butter, and of the ripening of cheese. The cause of the natural acidity of milk had been previously proved as not due to lactic acid. A fairly complete summary of earlier experiments on the subject will be found in LAFAR'S. *Handbuch der Technischen Mykologie*, and in Dr. FASCETTI'S, original article in our *Review*, February 1915.

When milk is retained for some time the acidity increase is due to the production of acids from the milk sugar by bacteria. After intermediate phases when the acidity reaches about 0.3 %, the milk will curdle on boiling, and when it reaches between 0.60 to 0.86 %, the milk coagulates spontaneously.

The author shows as a result of his own experiments, the change in the acidity of milks retained at three different temperatures in the accompanying graphs. In cold storage it should be noted that the acidity increases somewhat slowly and the maximum attained is about 1 %. At blood heat the acidity increases very much quicker and may attain to as much as 3 % in one week. The lowest acidity reached in one week at this temperature was 1.6 %. At room temperature the acidity increases at an intermediate pace, but the maximum attained varies very greatly, any thing from 1 to over 3 %. The explanation lies in the type of germ encouraged.

The principal acid producing bacteria in milk may be conveniently divided into four groups (LÖHNIS) as follows :

(1) *Lactic streptococci* ; a good strong culture of these germs, seeded into pasteurised milk should produce an acidity of 1 % in 12 hours, at 72° F (1 % inoculation).

(2) *Intestinal lactic bacteria*, which originate from excrement. They are over numerous in milk which has been ripened without the aid of a good starter.

(3) *Lactobacilli* (including *Bacillus bulgaricus*). At 1 %, inoculation of " lactigen " into pasteurised milk will produce about 1.2 % acidity in 12 hours at 98° F.

(4) *Lactic micrococci*, principally found in milk held in cold storage.

All four groups are found in commercial milks, and the author states that it is because the *lactobacilli* develop quickly and strongly that milk at blood heat develops so much acidity. They do not develop in cold storage, and it is not certain at room temperature. When the acidity of

(1) See *R.*, Sept. 1918, No. 1046 and *R.*, Dec. 1918, No. 1418. (*Ed.*)

milk exceeds 1.25 %, it can usually be proved that they are present and when they do develop, the high acidity produced favours the growth of yeasts, which subsequently reduce the acidity.

Experiments with subcultures from milks held in cold storage, at room temperature and at 98° F, indicate similar results, and agree with the results obtained by ORLA JENSEN, ROSENGREN and others on the bacteriology of butter.

Other organisms sometimes taking part in the final reduction of acidities were moulds, *Oidium lactis*, *Penicillium*, etc.

Experiments with pasteurised milk showed that the 4 groups of lactic bacteria do not form spores, and so do not survive pasteurisation. When milk is pasteurised, spore forming rods survive. When held subsequently at almost any temperature within reasonable limits, these milks finally curdle and at that time may or may not show an increase of acidity compared with fresh milk. The curd, however, begins to digest and the acidity of the milk will then rise.

1035 – **Decomposition of Hydrogen Peroxide by Micro-Organisms Extracted from Pasteurised Milk.** — FOUASSIER, M., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXX, No. 2, pp. 145-147. Paris, Jan. 12, 1920.

It is well known that hydrogen peroxide is decomposed when added to fresh milk. This is brought about by the influence of diverse catalases, some of which, physiological and some microbial. Amongst the latter the catalytic power of lactic ferments in particular has been carefully investigated, chiefly by SARTHOU (*Comptes rendus de l'Académie des Sciences*, Vol. CL, pp. 119, 1910). Whatever may be the origin of these catalases, they are destroyed, at least as regards their effects by pasteurisation. If to increase the length of preservation, hydrogen peroxide is added to milk which has just been pasteurised, the hydrogen peroxide disappears after a few hours and that, so the author has found, before the acidity of the milk thus treated shows any modification. It thus seems reasonable to suppose that in the pasteurised milk there are germs which resist pasteurisation and possess a strong catalytic action.

This is what the author tried to establish and his results are given in this article.

Cultures were made on lactose agar with several pasteurised milks in daily use. Besides the lactic ferments, the author has isolated several organisms, amongst which *Bacillus subtilis*, *Tyrothrix tenuis*, *Oidium lactis*, and a lactic yeast, have been met most frequently. In order to determine the comparative action of these organisms on hydrogen peroxide the pure cultures were made on a liquid lactose medium, peptonised and sterilised in a series of test tubes. One sample was kept as a control, one received 1 % of hydrogen peroxide of 12 volume strength, another received 4 % of hydrogen peroxide, then they were all kept to 30° C. in an incubator.

In all the tubes in which organisms developed, no hydrogen peroxide was found, but the opposite was the case when no organisms had developed.

B. subtilis and *Tyrothrix*, which are active catalysers, rapidly decomposed the hydrogen peroxide, even when it was added in large quantities, with the same intensity as the control.

The other organisms exhibited an increasingly feeble catalytic action, falling to zero for the lactic ferments under the experimental conditions. Thus, the smallest addition of hydrogen peroxide was sufficient to prevent the development of this ferment. It was indisputably proved in these experiments, that decompesition was brought about by diastatic action. This action was manifested even after the culture medium was filtered through a porcelain " candle " and was only arrested when heated to 80° C.

The organisms with the strongest catalytic power are those which produce spores which resist pasteurisation.

1036 – **Experiments with, and Practical Application of Heat Sterilisation for All Parts of Milking Machines.** — HART, G. H. and STABLER, W. H. (Department of Veterinary Science; University of California. Berkeley, California), in the *Journal of Dairy Science*, Vol. III, No. I, pp. 33-51, tables 7. Bibliog. of 13 publications. Baltimore, Jan. 1920.

A great many experiments have been initiated to ascertain the mechanical difficulties and the relative production that can be secured with the use of milking machines (1) as compared with hand milking. The authors have, however, devoted their attention to ascertaining the best method of eliminating excessive numbers of bacteria in machine drawn milk. They mention the most important works already published on bacteria in machine drawn milk and the use of various sterilising agents. Results are then given of tests carried out by the authors with C. H. Mc CHARLES (Chemist of State Food and Drug Laboratory) to show the reduction in chlorine content by oxidation in the presence of milk or rubber.

Three 1 ½ gallon glass jars were each partially filled with one gallon of water to which chlorine solution was added in the proportion of 3 or to 5 gallons. This is about the proportion usually recommended for milking machine parts. The chlorine solution before dilution showed 2.35 % available chlorine, and when added to the water in the above proportion, the fluid in the jars contained about one part of available chlorine to each 10,000 parts of water. Jar I was not disturbed; Jar 2 had 2 cc. of milk added daily; Jar 3 had some rubber tubing placed in it. Titrations for chlorine content were made daily.

The tests show that both milk and rubber reduce the chlorine content of solutions containing it and the more milk residue that adheres to the tubing, the quicker the chlorine becomes utilised.

The original plan of sterilisation of the parts of the dairy in question was to put the tubes and teat cups in a low pressure steam steriliser, but depreciation of the rubber was rapid: the authors installed instead a gal-

(1) See *R.*, May 1917, No. 483, Aug. 1917, No. 763; Sept. 1917, No. 859; Nov. 1917, No. 1074; Dec. 1917, No. 1208; Jan. 1918, No. 71; Feb. 1918, No. 221, June 1918, No. 695. (*Ed.*)

vanised iron tank 4 feet long 1 foot wide and 1 ½ feet deep, without any lid, and the parts placed in water in the tank and the temperature raised by steam to between 160° and 180° F. for 15 to 20 minutes.

Tests were conducted by running sterile water through the apparatus to be tested. The amount of water used in each test was 100 cc.

Milk counts over 7 days showed that sterilisation was sufficient to produce a milk well under 25,000 bacteria per cc., the limit for the grade.

The tinware on the ranch is regularly sterilised in an autoclave under pressure. In all, 113 samples of machine milked milk was collected and counted two samples were over 10,000; and the highest being 18,000.

The general superiority and efficiency of heat sterilisation is demonstrated and that it is the only way to successfully sterilise milking machine rubber parts under ordinary ranch conditions. Where it has been regularly done, no increased trouble with mammites has ever developed as a result of installing machines, and as low a bacterial count milk can be produced with milking machines as by hand milking. No chemical solution has been found successfully to accomplish these results under practical conditions.

1037 – **The Development, Production, and Trade of Italian Dairy Products.** — FASCETTI, G., in the *Giornale di Chimica Industriale ed Applicata*, Year II, No. 3, pp. 137-144, + 1 Diagr. Milan, March, 1920.

During the last 40 years the Italian cheese industry has made considerable and rapid progress in international trade, as is shown in the appended tables, and as this progress has only received a temporary set-back owing to the war, it seems opportune to offer a few remarks on the importance of the export of dairy produce and of considerations regarding the importing countries.

It is important to notice that the chief powers, such as the United Kingdom, France, North and South America, Austria, and Germany bought dairy produce on the Italian markets. England limited her demands to two principle articles, viz., Gorgonzola cheese and butter. This absorbed nearly half the total export of these products, but demanded but little in the way of herd cheeses such as " Grana " or " Caciocavallo ", which are in great demand in America. There is no doubt that the fault lies with the traders, and it is to be hoped that the industry will study and use the best means of putting before the British public the excellent qualities of the Grana and Provoloni cheeses. As the British have a special prediliction for fermented and piquant cheeses made from sheep's milk, like Roquefort, or from cow's milk, like Gorgonzola, they should most certainly like " Pecorino ", made from goats' milk. This last is a great table delicacy in North America, where the consumption amounts to 60 000 quintals every year. Italy has been very successful in the markets with imitation Swiss cheeses, of which France absorbs half the total export.

Year	Butter quintals	Cheese quintals
1876	16 082	18 151
1895	44 016	82 483
1901	60 512	109 336
1905	60 599	170 989
1906	50 596	191 936
1907	36 889	211 406
1913	27 276	321 242

Total export of Cheese . . . . . **327 059** quintals

Export of hard cheeses:

Grana	91 648
Pecorino	91 760
Emmenthal	9 451
Caciocavallo	27 113
Total	**219 972** quintals

Countries importing Italian Cheeses.

Other types of hard cheeses	15 501	
Total export	**235 473**	quintals
Export of Soft cheeses: Gorgonzola, Stracchino, Fontina	91 622	
Other types of soft cheese	683	
Total export	**92 305**	quintals

Austria-Hungary	15 056	quintals
France	4 524	
Germany	4 468	
United Kingdom	923	
Switzerland	9 468	
Argentina	26 720	
Brazil	5 551	
Chile	1 628	
United States	14 127	
Uruguay	1 230	
Other countries	7 944	
Total	**91648**	quintals

Emmenthal:—

Austria-Hungary	1 218	quintals
France	5 546	
Other countries	2 651	
Total	**9 415**	quintals

Pecorino :—

France	2 574
Germany	1 113
Libya	3 170
Tunisia	2 016
Argentina	3 392
Brazil	4 281
United States	67 609
Other countries	7 605
Total	**91 760** quintals

Caciocavallo :—

United States	25 119
Other countries	1 994
Total	**27 113** quintals

Gorgonzola and similar cheeses :—

France, United Kingdom and United States . . . . **91 622** quintals.

From this table, it is evident that Italy has made many openings in international commerce and is in a very favourable position, both agricultural and technical for the re-establishment her cheese export.

Already in 1919 there was an increase in exports compared with 1918, but unfortunately apthic fever in its worst form attacked the stock, and only the young were excluded from slaughter by Government order. However, the cheese production in 1919 was only slightly below that or 1918 and that for 1920 promises very well. Indeed the exports should rise by $^1/_5$ above those of 1919 and soon Italian dairy products should regain their favourable position in the international markets from which they had been cut off for more than 4 years (1).

1038 – **The Influence of Humidity Upon the Strength and Elasticity of Wool Fibre.** — HARDY, J. I. (Associate Wool Specialist, Wyoming Agricultural Experiment Station), in *The Journal of Agricultural Research*, Vol. XIX, No. 2, pp. 55-62, figs. 4, Washington, D. C., April 15, 1920.

In a preceding issue of this Journal the author published a preliminary report of his work on the influence of humidity upon the strength and elasticity of wool fibre (2) ; in the present article further studies are reported concerning scoured wool. As in the previous work, all samples were tested with a MACKENZIE fibre testing machine. Each sample has been extracted with ether and washed with hot water and tested at each of 5 relative humidities, 40, 50, 60, 70 and 80 %. The results are given in the Tables and may be summarised as follows :

The tensile strength of wool increases with the decrease in the diameter of the wool fibre. Fine wool has a breaking strength varying more

(1) See *R.*, 1914, pp. 842-849 note by Prof. C. BESANA entitled " The Dairy Industry in Italy at the Present Time. (*Ed.*)

(2) See *R.*, June, 1919, No. 780. (*Ed.*)

closely with the first than with the second power of the diameter. Coarse wool has a breaking strength varying with a figure which lies between the first and second powers of the diameter.

It is necessary to mix samples carefully before testing in a testing machine, if the best results are to be obtained.

The breaking strength and tensile strength of both scoured and unscoured wool decrease with an increase in relative humidity from 40 to 80 %, and show a tendency to increase from this point to that of saturation.

The elasticity of scoured and unscoured wool, increases with an increase in relative humidity from 40 to 80 %, and decreases from this point to that of saturation.

1039 – **The Rôle of Pentose-Forming Bacteria in the Production of Maize Silage.** — Peterson, W. H. and Fred, E. B. (Department of Agricultural Chemistry and Agricultural Bacteriology, University of Wisconsin. Madison), in *The Journal of Biological Chemistry*, Vol. XLI, No. 2, pp. 181-186. Baltimore, M. D., Feb. 1920.

The xylose-fermenting bacteria are present in large numbers in silage crops. Their optimum temperature for fermentation is about 27° C, which is approximately the average temperature found in maize silage ; in relation to oxygen supply, the pentose fermenters are most active when subjected to a low oxygen tension, and will ferment xylose under anaerobic conditions. They are particularly characterised by the ease and rapidity with which they ferment pentoses, producing chiefly acetic and lactic acids.

In the present article, the authors report on the results obtained by the inoculation of maize fodder at the time it was placed in the silo, including the micro-organisms present at the time.

The results of these experiments indicate the following points :

The pentose-fermenting bacteria are capable of bringing about decided changes in raw or in sterilised maize tissue. When added to raw maize fodder, these organisms are able to compete with the fermentation processes which normally occur. In sterilised silage, the pentose fermenters develop rapidly, and produce the substances commonly found in good silage ; *viz.* acetic acid, lactic acid, ethyl alcohol, and carbon dioxide. From the standpoint of temperature, oxygen sypply, and fermentable compounds, silage offers a suitable medium for the growth of pentose fermenters. This accounts for the fact that the authors conclude that these bacteria play an important part in the formation of maize silage.

1040 – **Effect of Humidity and Weather on the Ripening of Stored Apples and Pears** — See No. 954 of this *Review*.

1041 – **Export of Rice from Cochin-China to China and France.** — See No. 965 of this *Review*.

1042 – **Suggested Improvements in Methods of Selling Cotton Based on a Comparison of Cotton Producers and Consumer's Prices.** — McConnel, O. G. (Specialist in Cotton Marketing, Bureau of Markets), in *U. S. Department of Agriculture, Department Circular* No. 56, pp. 1-8. Washington, D. C., August, 1919.

Data prepared in accordance with a co-operative arrangement between the North Carolina Department of Agriculture, the North Caroline State College of Agriculture and Engineering and the Bureau of Markets of the United States Department of Agriculture, based on a comparison of cotton producers prices and those paid by the consuming mills for the same grades and staples of cotton on the same days.

During the period from December 14, 1916 to May 1, 1918, over 15000 samples were collected and specified and a form was furnished showing the date of purchase, price paid on delivery, and stipulated grade and staple. During the same period the county classers in the State classed about 120,000 bales of cotton for producers in North Carolina, and obtained information as to the date and place of sale, and the price received for a large portion of this cotton.

A comparison of all coinciding sales selected from the sale of approximately 200,000 bales sold in the States of North Carolina, South Carolina, and Georgia showed that the mills paid an average of $11.60 per bale more than the average price received by the farmer on the same date for cotton of the same grade and staple. Whether sold through buyers or dealers or direct to the mills, there are usually certain legitimate expenses of selling which would reduce the actual saving below the amount indicated, less $2.50 for freight and other charges per bale.

The suggested improvements in methods of selling cotton include the following points : farmers should grow only the quality of cotton such as the mills need; a compress and ample storage and shed space should be provided ; a disinterested classing service and cooperative selling should be instituted ; better ginning facilities are needed ; less damaged cotton should be shipped to the mills ; varieties that produce a better staple should be grown.

DISEASES OF PLANTS

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

GENERAL

1043 – **Researches on the Presence of the Hyphomycete *Endoconidium temulentum* in the Seed of Darnel.** — D'Ippolito, J., in *La Riforma agraria*, Year I, No. 7, pp. 250-262. Parma, July, 1920.

MM. Guerin and Vogl discovered between the integument and the aleurone layer of the seed of darnel (*Lolium temulentum*), a mycelium that has since been the subject of many researches, the results of which, however, have been far from agreeing. The fungus was given the name of *Endoconidium temulentum*, but was subsequently identified as *Fusarium metachroum*.

According to some writers, the seeds of *L. temulentum* are always and everywhere infested by this fungus; while others maintain that whereas seeds from some localities are infected, there are certain places where the seeds are always free from the hyphomycete.

The author set himself the task of ascertaining whether the immunity enjoyed by certain seeds is due to the hyphae being unable to penetrate into the tissues, owing to some special power of resistance characterising the latter, or whether these seeds belong to some particular immune variety of darnel hitherto confused with another kind which is subject to the disease. He therefore tried to ascertain whether the healthy seeds came from completely immuned plants, or only from infected individuals with some isolated immune seeds, and found that all seedlings grown from healthy seeds were free from disease (some of these seeds came from Rome and others from Russia), whereas those raised from diseased seeds were wholly infected, or partially so in the sense that it might be limited to a portion of the aleurone layer. Further he found that it was not probable that the infection was transported through the air. Microscopic examination revealed no difference in the structure of healthy and diseased seeds; it is therefore impossible to explain how the mycelial hyphae have found an entrance in some cases and not in others. In addition, no difference was to be observed in the germinating power. On the other hand, morphological differences did exist, some of the spikelets being awned and the others not. The seeds of the former were all immune, whereas those of the latter were all infected. It thus appears that the two varieties of darnel, the awned and

the awnless, also differ in the fact that the one is a host of the fungus, and the other is free from it, which is a matter of great practical interest, given the toxic character of seeds infected with *L. temulentum*.

1044 – **Temperature Relations of Certain Potato Rot and Wilt Producing Fungi.** — EDSON, H. A. (Pathologist) and SHAPOVALOV, M. (Asst. Pathologist. Cotton Truck and Forage Crop Disease Investigations, Bureau of Plant Industry, United States Dept. of Agriculture), in *The Journal of Agricultural Research*, Vol. XVIII, No. 10, pp. 511-524, figs. 9, Washington, D. C., Feb. 16, 1920.

As shown by FAWCETT (1917), correlation exists between the cardinal temperatures of certain fungi in cultures, and their geographical distribution and seasonal occurrence. There is, however, a regrettable lack of exact information regarding the temperature relations of different potato parasites. The following data secured in experiments with pure cultures of some of the most common potato rot and wilt fungi explain to a certain degree the predominance of these organisms in definite regions and seasons, and permit certain practical conclusions regarding the temperatures which may control or eliminate these fungi.

The following cultures were employed: *Fusarium coeruleum* (Lib.) Sacc.; *F. discolor* var. *sulphureum* (Schlecht) App. and Wollenw.; *F. Eumartii* Carp., *F. oxysporum* Schlecht, *F. radicicola* Wollenw., *F. trichothecioides* Wollenw., *Verticillium albo-atrum* Reinke and Berthold.

The figures in graph form show the daily accumulations of growth, and a table gives the seasonal prevalence of *Fusarium oxysporum* and *Verticillium albo-atrum* under special climatic conditions. Results show that more tubers were infected with the former in the early crop grown at higher temperature than in the late crop at a lower temperature, and vice versa with *V. albo-atrum*. The presence of the *Fusarium* infection in the control tubers indicates that probably the largest part of it came from the soil, while the infection of the new tubers with *Verticillium* came exclusively from the seed The latter was absent both in the control and *Fusarium* plots of each crop.

The fact that the growth of potato fungi was seriously inhibited at or somewhat below 5° C is of considerable practical importance. It may be reasonably be supposed that a temperature of about 40° F or slightly below will suffice to check the spread of the Fusarium potato tuber rots in storage. The requisite temperature for successful infection is, therefore, higher than the minimum temperature necessary for growth in cultures. The susceptibility of *Verticillium albo-atrum* to high temperatures suggests the possibility of heat treatment for infected seed tubers.

Temperature tests in certain cases may serve as a useful supplementary method for the identification of fungi exhibiting contrasting thermal relationships.

1045 – **Preliminary Study of the Inheritanee of Rust Resistance in Oats.** — PARKER, J. H., in the *Journal of the American Society of Agronomy*, Vol. 12, No. 1, pp. 23-38. pl. 2, Bibliogr. of 19 publications. Washington, 20 Jan. 1920. RESISTANT PLANTS

This study was undertaken with the idea of attempting a determination of the genetic behaviour of the character rust resistance, in a cross between resistant and susceptible oat varieties of the two groups: (1) Red Oats

(*Avena sterilis*) and (2) Common Oats (*Avena sativa*), namely the pedigree lines of the two varieties Burt and Sixty-Day, with a large number of F_2 generation hybrids between them. Most of the inoculations were made on seedlings, but similar results were obtained on plants at the time of heading, using crown rust. *Puccinia Lolii Avenae* McAlpine on the upper leaf blades and stem rust. *Puccinia graminis Avenae* Erikss and Henn, on the upper sheaths and peduncles.

A plant was recorded as resistant when few or no normal uredinia ruptured the epidermis. If the uredinia were numerous, large and normal, but no very marked signs of resistance were present, the plant was classed as susceptible. If a limited number accompanied by flecks were noticed and no other indications of semi-resistance, the plant was classed as intermediate.

Everything tested was found to be readily susceptible to stem rust. All plants of the Sixty-Day were uniformly susceptible to crown rust. Of 223 inoculated plants of Burt, 48 were classified as resistant, 152 as intermediate, and 23 as susceptible. In the F_2 generation there was definite segregation, and the seedlings were classified as 17.3 % resistant, 13.0 % intermediate, and 69.7 % susceptible. Crown rust in this cross is partially dominant, and resistance is recessive. The outstanding contracted characters are due to definite genetic factors.

On this preliminary work the author does not consider it possible to attempt the construction of a factorial hypothesis to fit the results, owing to the fact that F_1 generation plants were not observed, nor the F_3 plants, as the F_2 plants were not grown to maturity. Also one of the parent varieties was heterozygous with regard to rust resistance. It is stated, however, that as the above results were obtained in the Burt × Sixty Day Cross, it seems likely that similar ones would follow in other crosses between varieties resistant to crown rust in the *A. sterilis* group and those which are susceptible in the *A. sativa* group.

A brief review is given of previous literature on disease resistance, and rust resistance in cereals.

1046 – **Correlation between Size of the Fruit and Resistance of Tomato Skin to Puncture; Relation to Infection with *Macrosporium tomato* Cooke.** — Rosenbaum J, and Sando, C. E., in *The American Journal of Botany*, Vol. VII, No. 2, pp. 78-82, tables 2. Brooklyn, Feb. 1920.

The fact that artificial infection with *Macrosporium tomato* Cooke from tomato on uninjured tomato fruit can be obtained, provided fruit of a certain maturity as measured by size is used, has previously been established. The question now under consideration is to ascertain the cause of this apparent immunity or resistance in the fruit after it reaches a certain maturity Previous investigations show that it is apparent that there is good evidence that some parasitic plants make their way into their host plants by breaking through the tissues mechanically and that the main factor in this penetration is the growth pressure of the fungus filament. Experiments by Hawkins and Harvey with *Pythium* on potatoes supports this evidence.

The results obtained by BLACKMAN and WELSFORD with *Botrytis cinerea* on *Vicia Faba* show that the piercing of the cuticle is due solely to the mechanical pressure exerted by the germ tube as a whole or by the special outgrowth from it.

The methods employed by the authors were as follows. The tomatoes were grown in a commercial way in the fields of southern Florida. At first fruits of various sizes were selected at random. Inoculations were made from tagged blossoms at the end of each week.

The *Macrosporium* cultures were isolated from tomato fruit. Spores were obtained according to the KUNKEL method.

The resistance of the skin of the fruit to puncture was determined by use of the JOLY balance as modified by HAWKINS and HARVEY. Generally ten punctures were made on each fruit where tomatoes of different sizes were used. The average of these readings gives fairly accurately the pressure necessary to puncture a particular fruit. The authors give Tables showing the relation between resistance of skin to puncture and *Macrosporium* infection on different sized tomatoes, at 23°C and showing the relation between these on tomatoes of different age.

The evidence obtained shows that: (1) while a chemical difference is found in the analysis of young and old fruits, this is not the limiting factor in infection with *Macrosporium*. The fungus grows just as readily on the pulp and extracts of old fruits as on those obtained from young tomatoes. Moreover, positive infection has been obtained on fruits of all degrees of maturity when the skin is injured or removed previous to infection; (2) surface sections of old and young fruits failed to reveal the presence of stomata or other natural openings in the skin; (3) in the development of a tomato fruit, the cuticular layer increases in thickness with the age of the fruit. Measurements to determine the resistance of the skin have shown that there is a definite and direct correlation between age and the resistance of the skin to puncture. Infection experiments have shown that the amount of infection which it is possible to obtain decreases with the age of the fruit.

While the results do not prove absolutely that the inhibition of infection is a purely mechanical one, the resistance of the tomato skin to puncture may explain, at least partially, the ease with which infection without previous injury is obtained on the young fruit but not on the older fruit.

1047 – **Riesling Rhenan Grape Variety Resistant to *Dematophora* sp. in Italy.** — See No. 944 of this *Review*.

1048 – **White Rot Disease of Onion Bulbs.** — COTTON, A. D. (Mycologist to the Ministry of Agriculture and Fisheries) and OWEN, M. N. (Botany School, University of Cambridge), in *The Journal of the Ministry of Agriculture*, Vol. XXVI, No. 11, pp. 1093-1099, pl. 2. London, Feb. 1920.

Until recently, this disease has not attracted serious attention, and the only previous account which deals in any way clearly with the White Rot disease is that by VOGLINO (1902) who records the occurrence in garlic in

various parts of Italy and gives a description of the microscopic characters of the fungus. As a result of further studies and experimental work carried out at the Ministry's Pathological Laboratory at Kew, during the past 2 years and the fact that the life history of the causative organism is properly known, has led the authors to state that it is now possible to suggest methods for controlling the spread of this disease.

The destruction of onion bulbs by a fungus producing a white mould was observed by BERKELEY in 1841 and was called *Sclerotium cepivorum*. An examination and comparison of these specimens shows that they are precisely identical with the White Rot fungus so prevalent to-day. The fungus has itself been found to be quite distinct from the two fungi *Sclerotinia bulborum* and *Botrytis cinerea*, both of which have at one time or another, been regarded as the cause of the trouble in question. White Rot was first correctly distinguished in England in the *Annual Report of the Plant Disease Survey of the Ministry of Agriculture, for* 1917. The popular name is derived from the abundance of white mould at the base of the diseased bulbs in the early stages. Onions become attacked when the soil in which they are sown or planted is contaminated with the fungus. They usually first show symptoms of attack at the end of May or early in June. If the soil is heavily contaminated, practically all the beds will be effected. Autumn sown plants appear to be the earliest to suffer but spring sown onions suffer equally, and, being smaller, are more quickly killed and are sometimes destroyed in large numbers. The earliest visible symptom is one of wilting and yellowing of the foliage. The roots are invaded by fungus mycelium or spawn, and are almost entirely destroyed, probably in all cases attacked before the bulb. Warm, damp weather appears to be specially favourable to the growth of the parasite, and the fungus then develops rapidly round the base of the bulb showing a mass of fluffy white fungus spawn or mycelium. This is very characteristic of the White Rot disease and distinguishes it at once from all other diseases of the onion. Later this is replaced by a more closely fitting weft which penetrates also into the tissues of the bulb. At this stage the surface of the bulb shows the presence of numerous, black spherical bodies (0.5 mm. diameter) and termed "sclerotia". It is by means of these that the parasites persist in the soil from year to year. The fungal threads continue to penetrate the bulb tissues, and finally the bulb becomes dried up. It would appear that under natural conditions, the sclerotia on the diseased bulbs, remain dormant during winter, germinate in late spring and thus bring about infection of the next crop.

The conidia or microspores produced after germination, have not been observed to germinate.

It would appear, therefore, that the disease is spread solely through the agency of sclerotia. This accounts for the fact that the authors prefer to retain BERKELEY'S generic name *Sclerotium* rather than to transfer species to the ascomycetous genus *Sclerotinia*.

A point of great practical importance is the length of time the sclerotia

retain their vitality. No exact statement can yet be made in this respect.

Method of spread. — The introduction into new localities obviously takes place through such means as (1) the distribution of soil containing sclerotia ; (2) the planting of diseased plants and sets ; (3) the careless disposal of contaminated refuse or manure.

As far as the present observations go, most of the common varieties of onions appear to be subject to White Rot. Shallots are usually resistant and leeks are not commonly affected.

Distinctions between White Rot and other diseases. — (1) « Onion fly » *Phorbia ceparum* distinguished by presence of maggots in the bulbs, the absence of white fungus mycelium, and black sclerotia.

(2) « Milaidev » *Peronospora Schleideni* distinguished by whitish black or grey mildewon the leaves bulb free from attack.

(3) « Onion Smut », *Urocystis Cepulae* streaks of black spore masses in leaves and the outer scales.

(4) *Botrytis Allii*. The leaves and top of the bulb attacked, with grey mould and not white ; and disease commences later in the year. This disease and White Rot are occasionally found in the same bulb.

In England, White Rot is very widespread. It is evidently also serious in Italy but little is known as to its exact distribution on the continent. It has not been reported in America.

Methods of control. — The only means at present known is by starving out the fungus from the soil, and this can only be effected by keeping the ground free from onions and allied crops for a number of years. During this period the soil should be worked as much as possible and the utmost care taken that contaminated soil is not conveyed to clean land.

Diseased plants should be carefully dug up and burned before the formation of sclerotia takes place. No success has been obtained yet with the use of soil fungicides.

There is therefore still room for further investigation especially with regard to fungicides and trials as to the susceptibility and resistance of different varieties of onions.

1049 – **Rot of Date Fruit.** — Brown, J. G. (Agricultural Experiment Station, University of Arizona. Tucson), in *The Botanical Gazette*, Vol. LXIX, No. 6, pp. 521-529. figs. 5. Chicago, June, 1920.

Examination of the infected orchards at Yuma and Tempe, led the author to observe that the fruit showed two main symptoms of disease. Some were flecked with rusty brown spots, others showed soft spots varying in size and partly translucent, as though soaked with water or oil. In both cases, the ruptured epidermis allowed excessive water loss, resulting in the final mummy stage. Mummified fruits sometimes remained for a time *in situ*, but finally fell to the ground. The brown spots on petioles and ribs

of leaves, and on the rhachi of fruit clusters suggested a relation between fruit spot and leaf spot. This appears to be conformed by laboratory experiments so far completed. Cultures gave typical *Alternaria* spores similar to those found in pustules in all three cases, also two species of *Aspergillus* and one species of *Penicillium*. The same saprophytic molds that occur in infected petioles, rhachi and fruits are likely later to ruin the packed crop.

Attack of the spot fungus, unaccompanied by the saprophytes, results in mummification without the appearance of rot.

The fungi *Sterigmatocystis* and *Meliola* have not yet appeared on any of the Arizona material examined. These fungii have previously been reported as connected with date rot in Africa, according to other investigators.

Further study is now being made by the author to determine the three species mentioned: *Alternaria*, *Aspergillus* and *Penicillium*, isolated in cultures, together with histological investigation and inoculation.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERAL

1050 – **Invasion of Locusts in Uruguay in 1917-18 and 1919-20** (1). — República Oriental del Uruguay, Ministerio de Industria, Defensa Agrícola: I. *Memoria correspondiente al año* 1917, **passim**. Montevideo, 1918. — II. *Memoria de los trabajos realizados contra la langosta. Invasión de* 1917-1918, pp. 89, maps, 4 diagrams. Montevideo, 1919. — III. *Boletín mensual*, No. 2, pp. 8-9. Montevideo, 1920.

In June, 1917, the Directorate of the Uruguayan " Defensa Agrícola " drew up a general scheme of work to be carried into effect, should the territory of the Republic again be invaded by locusts (*Schistocerca paranensis*) This scheme having been approved by the Central Commission, the Directorate took steps to re-organise the Commissions appointed in each Department for the purpose of collaborating with the officials of the Defensa Agricola, and to co-ordinate their work with a view to rendering it more efficacious. To this end, the Commissions were divided into three categories: " Comisiones de Zona " " Comisiones Seccionales ", and " Comisiones de Distrito "

The first regulation defined the powers of the Comisiones de Zona, another defined thefunctions of the two other categories of Commissions, while a third provided for the nomination of Honorary Inspectors having the same powers as the members of the " Comisiones Seccionales ", and the " Comisiones de Distrito ", thereby still further enlarging the circle of the collaborators of the Defensa agrícola.

With the aim of enlisting the services of the rural population in the campaign against the locusts, circulars were sent to all institutions which had to do with agriculturists asking them to collaborate and urging them to second the efforts of the " Defensa Agrícola ". The Directorate had a coloured plate made, depicting in a striking manner the characteristics of the " langosta " in the different phases of its life-cycle (egg ; " mosquita ",

(1) See: International Institute of Agriculture. *La lutte contre les sauterelles dans les divers pays*. Rome, 1916, **passim**. *R.* July, 1917, No. 690. (*Ed.*)

" saltona ", and voladora "), and giving the general principles on which are based the control measures adopted in the case of each of the stages in the life of the orthopteron. Another plate was also prepared, in order to help to intensify the control operations during the " mosquita " stage (when the insect is just hatched), for this is considered the best and most economical time for operations against the locust. These plates together with propaganda literature were distributed throughout the country.

In order to awaken popular interest, and to provide the commissions with a practical guide, the laws and regulations to be observed and enforced were collected in a single volume.

Suitable measures were also taken to increase the staff working directly under the " Defensa Agrícola ", and that to be dispatched to the invaded Departments.

With a view to regulating and rendering uniform the measures adopted by this staff during the campaign against the locusts, regulations were published dealing with the infringements of the rules in force for the destruction of the pests, the penalties to be inflicted on persons transgressing them, and the carrying out of the control work by official bodies of workers at the expense of the guilty party.

Another regulation was drawn up for the arrangement and coordination of all matters relating to the administration of the funds necessary for the control campaign.

On August 27, 1917, the first winged swarms (" voladoras ") of the insects, coming from Brazil, reached the territory of Uruguay by way of the Department of Artigas. The following day others came from Argentina and Brazil to the Departments of Salto and Artigas. From this date, these swarms of winged insects continued to invade the Republic; they gained ground gradually, and finally on November 20, reached the south frontier of Uruguay and spread over the Department of Montevideo up to the Capital and to the Departments on the banks of Rio de la Plata. In the meanwhile, in the districts first invaded by the " voladoras " the eggs laid at once by the latter began to hatch out and produce " mosquitos ", which continued to make their appearance until early in January, 1918. Towards the middle of December, 1912, large swarms of " saltonas " (locusts still in a wingless condition) coming from Brazil arrived in the Department of Rivera. Recently metamorphosed winged insects were not seen until the end of January either in this Department or in the Department of Cerro Largo. In February, however, they were observed in the other Departments of Paysandú, Minas, Tacuarembó, Florida, and Rio Negro. In short, all the Departments of the Republic were invaded, and everywhere the locusts had laid their eggs and the larvae were hatching out. The persistent drought prevailing during the months of the invasion of the locusts, and the time when their eggs were hatching, caused many of the latter to perish while others produced " mosquitas " out of season. These larvae died in large quantities in some zones as soon as they were hatched, and in certain places all succumbed to the unfavourable atmospheric conditions and to lack of food due to the dryness of the ground. The first rains brought

forth new " mosquitas ", it was therefore necessary to resume control operations although they were supposed to be finished, which entailed two consecutive campaigns.

From the time of the arrival of the first swarms of locusts in Uruguayan territory, that is to say, from September, 1917, to March, 1918, all the necessary material for the control campaign was distributed throughout all the Departments. This material, which was the property of the " Defensa Agrícola ", was lying ready for use in the depôt at Sayago. It chiefly consisted of a large quantity (387 949 kg.) of wire netting, (*barrera metálica*) 5343 special blowlamps (*máquinas langosticidas a fuego*), and 12 000 were nets fixed to a wooden grip (*látigos de alambre*) with their accessories (1). Further, measures were taken for the purchase of 2000 cases of naphtha, for fuel for the blow-lamps (*máquinas*). Most of these cases of naphtha were re-sold to persons requiring them at half-price, and a smaller number were distributed gratuitously to poor farmers. In order to do away with the difficulties experienced in previous campaigns connected with the distribution, and still more with the collection, at the close of the season, of the material lent to private individuals, the Directors of the " Defensa Agrícola " published a special regulation urging that due attention should be paid to the provisions it contained. In spite of the greater punctuality with which, thanks to these measures, this material was returned, the Directors find it increasingly necessary to insist upon private persons providing their own material, the " Defensa Agrícola " only undertaking to furnish it in exceptional cases, and as each occasion arises.

The National Army contributed efficaciously to the destruction of the locusts, and its co-operation was enlisted in nearly all the Departments; in some cases bands of workers were formed consisting almost entirely of soldiers. The railway companies also contributed to the success of the campaign by transporting workers and material free of charge.

During the time of the invasion in question, a special commission appointed by the Government carried out three successive experiments in applying the biological method (*Coccobacillus Acridiorum*) in the control of " saltonas " and " voladoras " (2). This Commission, though it considered the results obtained in these researches to be satisfactory, expressed the opinion that, in order to arrive at definite conclusive as to the practical value of the method, it would be necessary to carry out further experiments, especially as regards the treatment of wire " langosta " in open country.

A second Commission was appointed to undertake experimental investigations with a view to the industrial use of locusts (3).

The campaign of 1917-1918, considered as a whole, gave satisfactory results. The agricultural districts of the Republic were defended against the locusts and protected from their voracity, the injury they caused

(1) See, in this connection, the two publications of the INTERNATIONAL INSTITUTE OF AGRICULTURE mentioned in the preceding note.

(2) See *R.*, Oct.-Dec., 1919, No. 1281. (*Ed.*)

(3) See also *R.*, June, 1919, No. 690. (*Ed.*)

being reduced to a minimum and negligible in the total estimate of national production.

The direction of the work must also be regarded as better, than that of previous years. The more complete and uniform character of the regulations, and the distribution in all the Departments of a picked staff of workers chosen by and directly under the control of the " Defensa Agrícola " facilitated the execution of the control operations and permitted of greater regularity in the supervision of the various services. Although the invasion of 1917-1918 was one of the most widespread, yet only half the funds voted by the Assembly (120 000 pesos) was expended on the operations.

Contrary to what occurred in the above-mentioned period, the 1919-1920 invasion, according to the information so far published (February 1920), was not very severe in Uruguay. The first winged swarms found their way into the Republic at the end of July (27 and 29) across the Departments of Salto and Rivera ; they came from Argentina and Brazil, respectively Early in the following August, however, the locusts that had invaded the Department of Rivera returned to Brazil. The arrival of small swarms was afterwards notified in the two above-mentioned Departments. A swarm composed of a few insects was reported on October 9, 1919 at Tacuarembó ; this was the only one that stopped in the country. The measures necessary for protecting the invaded estates were carried out with promptitute and energy by the owners in collaboration with the " Defensa Agrícola ".

1051 – ***Empoasca mali* and *Empoa rosae*, Two Leaf-Hoppers Injurious to Apple Nursery Stock in the United States.** — ACKERMAN, A. J., in *United States Department of Agriculture, Bulletin* 805, pp. 1-35, figs. 2, pl. 5, tables 21, Bibliogr. of 28 publications. Washington, D. C., Dec. 15, 1919.

INSECTS ETC. INJURIOUS TO VARIOUS CROPS

The Apple Leafhopper (*Empoasca mali*), both in the nymph and adult stage, causes serious injury to apple nursery stock by extracting the plant juices from the terminal leaves of the host. As a consequence the leaves curl, become undersized, and fail to function normally, thereby retarding the growth of the trees. In southern Pennsylvania this species is three-brooded and hibernates only in the adult stage. Eggs are laid within the leaf tissue on the underside of the leaves. This leafhopper is widely distributed over the United States, and attacks a variety of plants.

In literature, the above species has been confused with another leaf-hopper which also attacks the foliage of nursery apple trees, namely, the rose leafhopper, *E. rosae*. The latter insect is two-brooded, and winter is passed in the egg stage. Winter eggs are deposited under the bark of apple trees ; these hatch out about a month earlier in the spring than eggs deposited by wintered females of *E. mali*.

E. rosae may be distinguished from *E. mali* by its lighter colour and by the absence of the six or eight white spots present on the frontal margin of the pronotum of the latter species. Distinction between the nymphs of the two species is more difficult. The distinct types of injury produced by the two insects, however, is a ready means of distinguishing them.

E. rosae feeds on the lower leaves and produces white or yellow spots on them, while *E. mali* attacks the terminal leaves, curls them, and stunts the growth of the trees.

Parasites seem to play a far more important rôle in reducing the numbers of the rose leafhopper than those of *E. mali.* Larvae of drynid parasites are quite common on the adults of the former, while they have only rarely been founds attacking the latter. Two parasites of the winter egg of *E. rosae* have been observed, namely, *Anagrus epos* Girault and *A. armatus* Ashm. var. *nigriventris* Girault, and these help considerably in checking the numbers of this species. No parasites have been reared from the eggs of *E. mali.*

A single spraying with 40 % nicotine sulphate at the rate of 1 to 1.500 combined with soap will so materially check an infestation by *E. mali*, when applied against the first-brood nymphs, that injury caused later by those that escape, will be of little consequence. The same treatment made two or three weeks earlier is effective against *E. mali*, although this species is seldom sufficiently injurious to justify a special application.

INJURIOUS VERTEBRATES

1052 · **Rats in Sugar-Cane.** — Skaife, S. H. (Entomologist, School of Agriculture, Cedara, Natal), in *Journal of the Department of Agriculture*, Vol. I, No. 1, pp. 55-57. Pretoria. April 1920.

The rats causing the trouble are not the cane rats (*Thryonomys swinderenianus*), but are nearly all allied to the common house rats. On the sugar farms of the Umfolozi Flats they cause great damage by gnawing through the base of the cane, causing it to fall and dry out. This particular species has previously been associated with the cottonfields, but this new and unprecedented form of attack, amounting to 75 % or more crop losses, is considered probably due to the floods, as it is obvious that the worse infested farms are those which suffered most from these floods.

The " Pâte verte " from the Pasteur Institute, Paris, although highly effective against rats in the trenches during the war, was found to have no effect on the species in question. The fact should not however be forgotten that the virus. was used when at least 2 months old. Poison baits soaked in 2 % solution of strychnia hydrochloride were more effective but impracticable under field conditions. The practice of the planters to burn the trash and dead vegetation before cutting the cane was more advisable. The rats were dazed and stupefied and were easily caught and destroyed.

The planters are, however, very anxious to have the speedy use of a virus which will start an epidemic among the rats and eventually wipe them out, and which, contrary to certain types of virus already put on the market, will prove as equally effective in the cane fields as elsewhere. Such a method of eradication would be distinctly advantageous to the burning process which involves injury to the roots of the cane by digging, etc.

[1051-1052]

Alfredo Ruggeri, *gerente responsabile.*

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The Editor's notes are marked (*Ed.*).

INTERNATIONAL INSTITUTE OF AGRICULTURE
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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

1053 - **Agricultural Development in India.** — I. CLOUSTON, D. (Director of Agriculture Central Provinces and Behar). The Possibilities of Agriculture in India within the next Twenty Years, in *The Agricultural Journal of India*, Vol. XV, Pt. III, pp. 239-249. Calcutta, May 1920. — II. HOWARD, A. (Imperial Economic Botanist). The Improvement of Crop Production in *The London Corn Circular*, Year, 77, No. 62, pp. 4-5 and No. 64, pp. 3-6. London, July, 1920.

I. — The Presidential address to the Agricultural Section of the Seventh Indian Science Congress, Nagpur 1920.

The speaker starts by giving a brief survey of the history of agricultural development in England showing the manner in which difficulties similar to those now experienced in India were overcome. The value of agricultural science is becoming more and more evident, and the Indian Industrial Commission States that the striking results which followed quickly and directly after the employment from about 1905 onwards of scientific specialists, demonstrates the wisdom of investing in modern science. The activities of the Department of Agriculture extend over a wide field now including not only crop improvements, but also the introduction of better and more intensive methods of cultivation.

The introduction of superior varieties and strains of seed and the cultivation of cotton (2 ½ million acres), of wheat (1 million acres) and of rice (1 million acres) and the annual profit accruing from their cultivation all points to a marked progress.

To meet the growing demands satisfactorily, there is now an urgent need of : 1) Assistance in devising suitable implements; 2) depôts for demonstration generally; 3) investigation and means of combating the fungoid

diseases and insect pests ; 4) adequate provision for experiment and research. Each talug or tahsil (agricultural association) and union should have its own Government Farm and should be the centre for help, advice and instruction. District talug agencies organised carefully would be a medium through which legislative measures for the advancement of agriculture, and the amelioration of the people would be carried out.

The speaker closes by mentioning the great future possibilities, and considers that the successes will undoubtedly surpass the highest expectation if the process of reconstruction is dealt with in an adequate manner.

II. — Paper read before the Royal Society of Arts. The necessary steps which should be taken in connection with general improvement are entirely in accordance with the statements made by CLOUSTON but the paper includes further additional remarks worthy of note.

1. IMPROVEMENT OF VARIETIES: SOME VARIETAL CHARACTERS. — Modern industry demands a uniform product. The first stage of improvement lies in the cultivation of an even product free from admixture. Although yield is of such paramount importance in India, the growing period is much more strictly limited than in other countries. Early sowing is impossible and late sowing means a great slowing down in growth, and the crop cannot ripen in time. A great improvement in yield has been obtained by introducing a wheat of shorter growing period which can use up the limited time to the best advantage and can produce a well developed grain even in unfavourable years.

Adaptability is the essential to the successful variety. Replacement must be carried out according to plan, and admixture with inferior types easily detected. Accurate mathematical investigations to determine which of a set of varieties is the best yielder, although probably extremely useful in England, are often inapplicable to Indian conditions.

Although quality combined with quantity is a difficult matter, high yields can be united with quality far above the average *e. g.* varieties of cotton, wheat and tobacco ; but the greatest attention must be paid to the prevention of cross fertilisation in the field, otherwise improved cotton etc. will rapidly degenerate. Hence the importance of well organised seed supply. The local centres have mostly been managed privately or by District Boards etc, but with the newly aroused interest in general development, the talug agencies are likely to aid progress to a large extent. The best methods of finance are still under consideration, and the method has not yet been satisfactorily solved.

2. FACTORS INFLUENCING PLANT GROWTH. (a) *Soil aeration*. — The author deals with three cases in which progress has been obtained through the recognition of the importance of this factor :

1) *Canal Irrigation* : — To overcome the difficulty which arises owing to the fact that irrigation supplies water but tends to deprive the the soil of air, it was important to arrive at a working compromise. A large number of experiments were carried out. The following is a brief summary of the results obtained : —

1. *Average yield of wheat grain per acre at Quetta with single irrigation.* Maunds 17 Seers. 29. (One Maund = 40 Seers = 82. 27 lb).

II. *Introduction of new limiting factors after irrigation.*

Number of waterings	Area in acres	Total weight of produce lb	Total weight of grain		Yield of grain per acre		Percentage reduction
			m.	s.	m.	s.	
One	3.99	10.367	52	6	13	2	0
Three	2.65	6.620	25	15	9	23	26

Similar results were obtained in Punjab in Sind and in the United Provinces. A consideration of all these results indicates that over the canal irrigated areas of North West India, a vast volume of water is annually poured on to the land to no purpose. At a comparatively early stage in irrigation, the soil aeration is interrupted, after which any further addition of water does not affect the yield. Consequently, water has been wasted and natural soil fertility lowered, as is seen by the gradual falling off in yield in new canal areas, and by the increase in the area of alkali lands. Payment by volume would remedy the defect to a very considerable extent.

2) *Development of waste lands.* — The second practical application of soil aeration. Reference is made to the work of CLOUSTON in the Central Provinces, who was the first to make practical use of the fact that soils possessing great porosity often prove to be of the greatest value. In these Provinces, large areas of poor laterite soils possess this porosity and hence with proper administration, the present results. Crops of over 40 tons of stripped cane per acre have been grown, and also heavy yields of cotton, groundnuts, indigo seed and fodder, more especially on the poor *bhata* soils than on the richer black neighbouring soils which were far less permeable.

3) *Drainage.* — That the loss of fertility is largely due to denitrification is shown by the results of an experiment at Pusa in 1910. A plot of heavy land was water logged during September to compare its behaviour with normal plots on either side. Across the middle of the plots 4 cwt., of nitrate of soda per acre was applied previous to sowing with wheat. The effect after a month's water logging was to reduce the yield by about 16 bus, per acre. The Botanical area at Pusa has been transformed by improving surface drainage, and the experience there during the last 15 years has thrown light on the nitrogen problem in India (1).

(1) Surface drainage, by checking erosion and by reducing denitrification in the rains has had the effect of increasing the fertility with a comparatively small expenditure of organic matter. One plot during 15 years produced 13 heavy cereal and 2 good pulse crops (manurial treatment 3 crops of green manure, single dressing of castor cake 1/2 ton per acre). The land improved and in 1919 gave a record crop of wheat, viz 40 bus., per acre. Similar results have been obtained at Quetta and in the United Provinces. This suggests that nitrogen fixation is much greater in the plains of India than is commonly supposed. (*Author's Note*)

A detailed drainage map of the area to be improved is obviously the first condition of success, and a settled policy for investigation and action is essential.

b) SOIL TEMPERATURE. — A practical demonstration has shown that the cause of the damage to crops in Bihar is not the white ants, as is sometimes supposed, but the high temperature of the subsoil, leading to partial destruction of the root system. Afterwards the white ants devour the sickly plants. By lowering the soil temperature, leaving the furrows open for sufficient time to cool the soil by evaporation and postponing the sowing, the necessary remedy is effected. Futher investigations are certain to lead to results of great economic importance.

The author points out that science is the instrument by which the advance is made, and the importance of the combination of the scientific investigator with the cultivator from the point of view of trade, is essential if success is to be ensured.

RURAL HYGIENE

1051 – **Research on the Sewage Water of Milan.** — BERNARDI, B, in *Reale Isituto Lombardo di Scienze e Lettere, Rendiconti*, Series II, Vol. III, Parts 6-7, pp. 222-243, Milan, 1920.

In 1900, the municipal authorities of Milan appointed a Commission to study the state of the sewage of the city as much from the hydrotechnic and hygienic standpoint as from that of construction. The examination of the degree of purification of the sewage was entrusted to Prof. CELLI and Prof. MENOZZI and their report (A. CELLI and A. MENOZZI, *La depurazione agricola delle acque di fognatura di Milano*, Modena 1902) stated that the system employed for the purification of the sewage and its utilisation for irrigation purposes was extremely efficient and that it was satisfactory from the hygienic standpoint.

As it was feared that the system had not moved with the times the author repeated his esperiments in 1916 and 1917 and the results are given in the present article.

In 1915 the area, irrigated or irrigable by the Vetabbia canal, which carries away the sewage water was that shown in the following table: —

TABLE I. — *Land irrigated by the purified sewage water of Milan in* 1915.

	Meadows irrigated	Land under rotation crops	Total irrigated	Not irrigated	Total
	Hectares	Hectares	Hectares	Hectares	Hectares
Irrigated	3 298	1 100	4 398	500	**4 898**
To be irrigated	476	300	776	150	**926**
Prepared for irrigation	2 109	900	3 000	250	**3 250**
Suitable for irrigation	2 000	1 100	3 100	470	**3 570**
Total	**7 874**	**3 400**	**11 174**	**1 370**	**12 644**

The authors' researches show the purification of the sewage water to be very thorough. All substances such as sulphuretted hydrogen, faecal matter, ammonia, are reduced or disappear entirely owing to the water having been spread over the meadows. The same thing occurs with organic nitrogen, ammoniacal nitrogen and phosphoric acid. Bacteriological examination also shows purification to be very complete. On the other hand, the chlorides remain constant or even increase due to non absorbtion by the soil and evaporation.

In Table II, the analysis made by CELLI and MENOZZI, in 1900-1901 with those made by the author are compared :—

TABLE II. — *Comparison between the analyses made by* CELLI & MENOZZI *and by* BERNARDI.

	Analyses by CELLI and MENOZZI	Analyses by BERNARDI
Residue at 100° per litre	0.322 to 0.488	0.419
Residue at 280° » »	0.319 » 0.483	0.378
Residue « au feu »	0.279 » 9.425	0,371
Loss on calcination	0.023 » 0.068	0.027
Oxygen required to oxidise the organic matter	0.010 » 0.018	0.0154
Chlorine	0.005 » 0.0173	0.0273
Phosphoric anhydride	0.026 » 0.041	0.0139

Comparison of these two analyses shows that the purification of the sewage water of Milan is in the same state as in 1900. Moreover, on comparing the averages of a the authors' analyses with data supplied by KÖNIG on the composition of the sewage water of the big European cities, it becomes evident that the total amount of organic and mineral matter dissolved or held in suspension, as well as those which are the most important contamination (organic and ammoniacal nitrogen, chlorine, and signs of phosphoric acid etc.) is less than that of Paris, Berlin Dantzig, etc.

The agricultural use of sewage water gives rise to a few causes of disturbance but they can easily be obviated. In certain meadows irrigated with Vettabia water, certain bare patches can be seen which are covered with a brilliant greenish incrustation, from 1-3 mm thick, formed by algae. This trouble is overcome by preventing the irrigation water from stagnating. Also paper and débris accumulate and prevent growth, but this can be removed during the dry weather.

The greatest danger from a hygienic point of view is the contamination of the drinking water supply by drainage through the soil, but this has not happened yet and could easily be overcome.

In conclusion, it can be said that the irrigation of the meadows with sewage water is a cheap and effective way of combining hygiene and agriculture.

1055 – **Consumption of Milk and its Relation to Infectious Disease.** — *Communication from* Dr. KALLBRUNNER, *Austrian Correspondent of the International Institute of Agriculture.*

Before the war, British and German scientists found that an increase in the consumption of milk was accompanied by more cases of scarlet-fever but they where not able to find out the cause of this correlation. Austrian medical men and statisticians who had attempted in vain to discover the correlation before the war but during the war they were successful. In Vienna, the singular discovery was made that in the same degree as the towns' milk supply decreased, so did the cases of scarlet. fever, this confirming British observations. Statistics collected by the Office of Hygiene at Vienna show that the number of cases of scarlet-fewer were as follows :

Year	Number of Cases	Year	Number of Cases
1910	4 038	1915	5 093
1911	4 006	1916	4 534
1912	4 216	1917	3 134
1913	5 752	1918	2 832
1914	4 614	1919	1 234

The cause of this phenomenon is unfortunately not yet known, but it is thought that the constitution of children nourished on milk is more open to attack by the fever microbes, as they do not possess enough natural organic means of reaction to combat the disease. A considerable amount of research work on this subject is still necessary.

Typhus has almost disappeared in Vienna since the construction of the 2 large conduits which ensure the increased supply of pure fresh mountain water. Unfortunately isolated cases still occur and these apparently indicate the important part played by milk as the transmitting agent, the victims' having often been found to have obtained their milk from the same dairy. This observation was naturally of great importance to the medical experts, and at the appearance of each new case they immediately concentrated their attention on the dairies which had supplied the victims' milk. The success of these precautions is shown by the continual decrease of sporadic cases of typhus as well as small epidemics (certainly the cases of typhus in Vienna could not be prevented from increasing and it speaks very well for the efficiency of the measures taken, that the isolated cases did not develop into epidemics owing to soldiers who were on leave or had deserted, passing through the town).

The interesting cases cited further on, which were registered prior to the war and which led to the re-organisation of the dairies during serious times, prove how well justified were the rigorous measures taken by the sanitary police, in regard to the milk industry. Naturally these measures

were taken in complete accord and collaboration with the dairies, which are always eager to produce and deliver the milk under irreproachable hygienic conditions.

Previously no special importance had been attached to the state of health of the personnel of the dairies, periodical washing and visits to the doctor being considered enough. Some years age, a "koster" (a man who had to taste the milk from each can sent to the dairy) contracted typhus. Without falling seriously ill himself, he infected part of the milk he had tasted. About 3 weeks after the man fell ill 90 persons who had bought milk at this dairy became ill one after the other. The first to catch the disease were some employees who were in the habit of drinking milk from this diary at lunch time. A careful search was at once made, and the case of the "koster" 9 was discovered; about the end of 3 weeks, the epidemic of typhus disappeared automatically, but not before it had caused the death of a dozen persons.

In another dairy where a pasteuriser was broken, doubtful milk was sold during 3 or 4 days without being pasteurised. Although the time was so short, this negligence unfortunately caused a small epidemic, which broke out 3 weeks after, but although it was of short duration, it nevertheless proved fatal to many persons.

In Austria it is generally believed that tuberculosis is transmitted from the cow to man through the milk, but this fact is not scientifically established for certain and, although public opinion is to the contrary, primary intestinal tuberculosis is rare. In Dalmatia, where milk is not drunk, tuberculosis is very common, whilst in places where milk- drinking is on the increase, the disease is decreasing. In Vienna, where the milk consumption is decreasing, tuberculosis is increasing, obviously on account of other factors), as can be seen from the following Table:

Year	Milk consumed per day litres	Deaths due to tuberculosis litres
1914	900 000	6 223
1919	40 000	10 606

But in spite of the bad feeding and poor attention that the cattle received during the war, bovine tuberculosis is on the decrease. One reason of this was the requisitions from the farmers, who, being paid extremely low prices with no reference to weight or quality, delivered the worst they had got, the animals being usually those most susceptible to tuberculosis Some livestock owners even applied BEHRINGS inoculation test for tuberculosis so that they could dispose of animals shown to be infected..

This elimination of poor and doubtful animals has certainly had a beneficial effect on the general state of health of the cattle and this is shown by the fact the number of insurances paid by the "Nieder-Oesterreichische Landes-Vieh-Versicherungs-Anstalt" (Cattle Assurance Company of Lower-Austria) for cattle slaughtered owing to tubercolosis

has been steadily decreasing since 1913. Thus, out of 100 insured animals killed by order the number of cases from 1913 to 1918 where slaughter was due to tuberculosis was as follows :

1913–1914	1 305 cases
1914–1915	1 129 »
1915–1916	952 »
1916–1917	790 »
1917–1918	553 »

In 1918, the number of cases slaughtered increased slightly but cannot be taken as an average, owing to the small number of cattle on which insurance was paid that year ; observations made elsewhere confirm this statement.

This fact, which necessitates still further stastistical confirmation, suggests that there is no correlation between bovine and human tuberculosis as statistics collected by the Ministry of Health at Vienna and the reports of the Nieder-Oesterreichische Lands-Vich-Versicherungs-Anstalt of Vienna show that while bovine tuberculosis is diminishing, human tuberculosis is increasing.

1056 - **Study on the Antiscorbutic Value of Honey.** — FABER, H. K. (Laboratory of Pediatrics, Stanford University Medical School, San Francisco), in *The Journal of Biological Chemistry*, Vol. XLIII, No. 1, pp. 113-116. Baltimore M. D., August, 1920.

The recent paper of DUTCHER (*Journal of Biological Chemistry*, Vol. XXXIII, No. 1, p. 551, 1918) has demonstrated that honey contains a small amount of antineuritic vitamine (probably due to included pollens rather than to the soluble constituents).

This naturally raises the question whether honey contains other vitamines as well. No investigation regarding antiscorbutic vitamine in honey has yet appeared, and it was to throw light on this point that the author undertook the present study with guinea pigs.

In 9 out of a series of 10 guinea pigs fed on a diet of oats, water, and honey, severe scurvy developed in 4 to 6 weeks. It is probable that no antiscorbutic vitamine is therefore present in honey.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY

1057 - **Temperature Influence on Sowing and Harvest Dates of Spring Wheat, Oats, Potatoes, Maize and Cotton in the United States.** — KINCER, J. B., in *Monthly Wheather Review*, Vol. XLVII, No. 5, pp. 312-323, figs. 20, Washington, May, 1919.

There are certain restricted limits of time within which crops must be sown, defined by the temperature conditions of the locality, and a definite amount of heat is required to bring the crop to maturity and ensure good quality and high yield. The length of the period decreases in general with increase in latitude.

A certain amount of warmth is necessary for germination of seeds, the amount required differing for seeds of different plants : wheat and oats germinate at a much lower temperature than maize and may therefore be sown somewhat earlier than the latter. Maize in its turn requires less

warmth for successful germination than cotton, which must necessarily be sown later. In addition, a definite amount of heat is required after sowing to ensure normal development to bring the crop to maturity.

As a rough measure of this heat there may be used what is known as the " thermal constant " taking the starting point as the mean temperature at the date of sowing. The method for obtaining the thermal constant is quite simple ; taking for example the maize, if it is desired to compute this value in a locality where the normal temperature is 55 °F, at the average date of sowing, and the mean temperature for any month during the growing season is 75°F, the thermal constant for that month would be 75°F-55°F = 20°F multiplied by the number of days in the month. But if the normal daily temperature for any portion of a month should be less than 55°F, these days should be omitted, and only those days used which have a mean daily temperature of 56°F or higher.

Spring Wheat. — The principal spring-wheat belt comprises the States of Minnesota and the Dakotas-sowing usually begins in the Dakotas and Nebraska when the normal daily temperature rises to 37°F, and in Minnesota and Wisconsin when it rises to 40°F. The sowing period begins in the southern portion of the belt about March 20 and progresses northward at the rate of about 20 miles a day, reaching the northern areas about the middle of April, the isochromal line keeping on a level with the isotherms indicated.

Spring Oats. —This crop is grown more or less in nearly all sections of the United States. The principal spring oat belt, however, consists of a crescent-shaped area, extending from New England to North Dakota, bounded on the north by the Great Lakes, and on the south and west by a curve extending across central Ohio, Illinois, eastern Nebraska, and from thence northwest along the Missouri River. Sowing starts north of the Gulf States, when the normal daily temperature rises to 43°F, except in an area comprising Oklahoma, Kansas, Missouri, and the lower Ohio Valley, where it begins when the temperature is lower i. e. about 40°F.

Sowing starts in the central and southern Gulf States at higher temperatures than 43°F for the simple reason that the normal daily temperature never falls as low as 43°F. in that area.

The date of sowing is earlier in Georgia and the other Gulf districts (early part of January) compared with the late sowings in April in the extreme northern areas. (Dakota, Maine, etc.).

The mean daily isotherm (43°F) usually corresponds to the average date of sowing, viz. February 15, and progresses northward following along latitude 35 ; as it moves near the north, the date becomes continuonsly later, until in the States of Maine and Wisconsin, etc. the end of April and the beginning of June is reached.

Similar to wheat, the isochronal lines keep on a level with the isotherms.

Early Potatoes. — Early potato planting begins as a rule when the normal daily temperature rises to 45° F, except in the Gulf coast section where the temperature is always higher than 45°F. In the more southern districts planting dates from the latter part of December in

central Florida, to about February 10 in the central Gulf States i. e. 50° to 60°.

The 45°F. isotherm crosses North Carolina (Gulf States) about February 15 and moves thence north-east to south-east until it reaches central south Texas: it moves northward simultaneously with the isochronal line of the beginning of early potato planting, to the northern border States, (Dakota, Wisconsin, Maine) by May 1. Thus the planting of early potatoes usually begins in northern Mississipi about February 15, and in northern Wisconsin 2½ months later.

Maize. — Sowing begins as a rule when the normal daily temperature reaches 55°F. It should be noted that a mean temperature of 55°F in spring corresponds to the average date of the last destructive frost.

The 55°F isotherm crosses the district lying furthest south in Texas, following the northern latitude 30, on Febriuary 15, and gets later and later as it approaches northwards, until in Dakota, Wisconsin and Maine, May 15 is reached.

Cotton. — Planting does not begin in the eastern portion of the belt until the normal daily temperature rises to 60 or 62° F, and not in the western portion until 61 to 83°F is reached (west of the Mississipi). The dates vary from March 1 in extreme south of Texas to the last decade in April in the northern portion of the belt.

Thermal Constant. — The behaviour of the thermal constants has already been mentioned. The adjoining Table shows the data collected for maize and oats in selected localities.

The Table shows that the thermal constant for maize in the principal producing areas ranges from 1600°F to 1800°F, but farther north in Southern Michigan and in eastern South Dakota for example, it is from 1400° to 1600°F, due to the sowing of early-maturing varieties, and possibly also due to some extent to the longer summer days in the North. In some southern localities, where slower maturing varieties are sown, it runs as high as 2800°F.

The potential thermal constants for cotton calculated for the period extending from the average date of sowing to the average date of the first fatal frost in the autumn are as follows: Devils Lake (North Dakota), 1260°F (May 15-20 to September 11-15); Lincoln (Nebraska) 2017°F (May 1-10 to October 11-13); Memphis (Tennessee) 3696°F, (March 23-31 to November 1-2) and for Thomasville (Georgia) 4096°F (March 1-10 to November 11-14). While the thermal constant is thus evidently deficient in the north of the belt for successful commercial growth of maize, it is interesting to note the large surplus available in the South, which is more than double the amount necessary to mature the average variety of maize.

The thermal constants for cotton in selected localities are as follows:— Raleigh, N. C., 1860°F; Thomasville, Ga., 1975°F; Montgomery, Ala., 1900°F; Little Rock, Ark., 1910°F; Oklahoma, Okla, 1820°F; and Galveston Tex., 1810°. The mean daily temperature at the average date of the beginning of the sowing season in these respective areas is: Raleigh

60° F, Thomasville, 61° F, Montgomery, 62°F; Little Rock 62°F, Oklahoma 61° F; Galveston 63° F.

The area in which cotton can be successfully grown is limited by the thermal constant 2000°F between the normal daily temperature at the start of the sowing season and the average date of the first fatal autumn frost, as is shown by the records for the following localities near the northern limits of the cotton belt: Norfolk, Va., 2010°F; Raleigh N. C. 2190°F, Chattanooga, Tenn, 2000°F; Fort Smith, Ark., 2040°.; Oklaoma, Okla., 2140°F.

As previously stated, sowing usually starts when the mean daily temperature rises to 40°F, that is to say, before the advent of the vegetative period, which corresponds to a normal daily temperature of 4208°F. Computing the thermal constant for spring wheat from a 43°F temperature base or the beginning of the vegetative period, we find the following results: Bismarck, N. Dak., and Huron S. Dak, 1970°F; Moorhead, Minn., 1940°F; Madison, Wis. 1980°F.

1058 – **Effect of Snow on the Yield of Winter Wheat in Ohio, and in Illinois, U. S.** — I. SMITH J. WARREN, in *Monthly Weather Review*, Vol. XLVII, No. 10, pp. 701-702. II. ROOT C. J., *Ibid*, pp. 700, Washington, Oct. 1919.

I. — SNOWFALL AND WINTER WHEAT. — A heavy fall of snow is generally thought to be favourable for winter crops, especially if it comes late in the spring. Observations made by the author seem however to contradict this idea, as shown in the following table which gives the correlation coefficients between the snowfall and the yield of wheat in Ohio, 1892-1914 (January, February and March.)

Month	County	Correlation coefficient	Probable error
January	Fulton	0.42	± 0.13
February	»	0.12	± 0.15
March	»	— 0.84	± 0.04
»	Mayne	— 0.69	± 0.08
»	Seneca	— 0.48	± 0.11

This indicates that in north western Ohio, a heavy snowfall in January has a slightly favourable effect; in February, scarcely any effect, whilst in March it has a decidedly adverse influence. This unfavourable effect in March as evidenced in Fulton County (S. W. Ohio) is verified by the records for Wayne and Senaca counties (both in Northern Ohio.)

On the other hand, March with a heavy snowfall is cooler than normal, while a warm March is usually accompanied by a light snowfall. It has already been shown that a warm March, in Ohio is, always favorable for winter wheat. The correlation coefficient between the average March temperature for Ohio and the average yield covering a period of 60 years is ± 0.46 with a probable error of ± 0.06.

In view of the evident effect of March temperature and the relation between temperature and snowfall, the point has been raised that the damaging effect of the snow is more apparent than real and that it is due largely to low temperature.

To determine the real facts the author has calculated the partial correlation for the 3 factors, temperature, snowfall and yield, as indicated in the following equations:

Let r_{sy} indicate the correlation coefficient for the March snowfall and wheat yield in Fulton County, Ohio. $= 0.84 \pm 0.04$.

Let r_{ty} indicate the correlation coefficient for March temperature and wheat yield $= + 0{,}62 \pm 0.62 \pm 0.08$.

Let r^{st} represent the correlation coefficient for the March snowfall and temperature $= - 0.678 \pm 0.08$.

To eliminate the effect of the temperature and shown the influence of the snowfall alone the equation may be written:

$$r_{sy.t} = \frac{r_{sy} - r_{st} r_{ty}}{\sqrt{(1 - r_{st}^2)(1 - r_{ty}^2)}}$$

Inserting the various correlation coefficients and making the necessary calculation, we have $- 0.73 \pm 0.07$ as the correlation coefficient between the snowfall in March and the yield of wheat, after eliminating the temperature influence.

The snowfall influence is eliminated from the temperature correlaton in a similar manner as follows: —

$$r_{ty.s} = \frac{r_{ty} - r_{st} - r_{sy}}{\sqrt{(1 - r_{st}^2)(1 - r_{sy}^2)}}$$

Inserting the values and making the correlation coefficient between the March temperature and wheat yield is reduced from 0.62 ± 0.09 to the suprisingly low value of $0.13 + 0.14$, after eliminating the effect of snowfall.

The dominating influence of the March snowfall as compared with the March temperature is therefore plain.

Snow covering and winter wheat. — A heavy fall of snow may melt quickly and leave the ground bare a good part of a the month. On the other hand, a light fall may remain on the ground some time during continued cold weather. Hence the study of the effect of a covering of snow on wheat must be entirely separate from the study of the effect of snowfall on wheat.

The general opinion is that winter crops should be well covered with snow during cold weather and more especially when freezing and thawing conditions prevail. The observations made by the author and his collaborators in Fulton County, Ohio, show little to substantiate this opinion, and it is evident that the matter should be dealt with district by district, taking into consideration the numerous prevailing local conditions.

A correlation between the number of days with snow on the ground from December to March inclusive and the yield of wheat gave a coefficient of only — 0.14 ± 0.14. A correlation between the yield and the number of days in March with freezing weather, while the ground was bare, gave a coefficient of only — 0.01. Here again no real effect is shown although the calculation has been limited directly to March when there is always a greater danger of freezing and thawing on ground laid bare.

A correlation of the yield with the number of days during the whole winter with the ground bare and the temperature below 20°F produced a coefficient of 0.28 ± 0.14.

In every case, as a consequence, the relation between the yield and the duration of the snow covering is, contradictory to the generally accepted opinion, only slight or extremely limited.

There is on the other hand some evidence to indicate that it is more advantageous to wheat if it is not covered by snow during the month of January. A correlation by Cox between the number of days without a snow cover when the temperature was below freezing in January and the yield of wheat in Wayne County, Ohio, gave a coefficient of ± 0.49 probable error ± 0.11.

II. — In Illinois, cold winters with heavy snowfall are followed by light yield and vice-versa the winters with little snow are followed by good yields.

The author admits that this may be due partly to the fact that the temperature is less severe in winter seasons with light snowfall.

1059 - **Effect of Conditions of Temperature and Sunshine on the Development of Cultivated Plants.** — See No. 1073 of this *Review*.

1060 - **Quality and Value of Important Types of Peat Material:— Classification of Peat Based upon its Botanical Composition and Physical and Chemical Characteristics.** — DACHNOWSKI, A. P. ((Physiologist, Soil Fertility Investigations) in the *United States Department of Agriculture, Bulletin* No. 802, pp. 1-40, Bibliogr. of 27 publications. Washington, Dec. 29 1919.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

Up to the present time investigations have been entirely confined to European countries from the standpoint of interests combining agricultural and technical utilisation, and points to the importance of similar proceedings in the United States. Attention is drawn to the necessity of observing two essential qualifying factors in classification and selection for purposes of utilisation of these peat materials:— 1) Botanical composition and stage of disintegration in a deposit ; 2) Controlling basic factors to the degree of success obtainable.

Although surface vegetation of any unstable stage is significant in the determination of latent possibilities of peat land areas, it is equally necessary to note the profile structure of peat deposit, and the climatic and geological differences of these areas.

A number of features of peat deposits in Europe and in the northern portion of the United States are identical (1).

(1) See *R.* Sept. 1914, No. 848 ; *R.* Oct. 1916, Nos. 1060, and 1075 ; *R.* Dec. 1916, Nos. 1258 and 1323. (*Ed.*)

A tentative classification is given of important types of peat material with Tables showing their chemical and physical characteristics and was collected from Europeans sources for use comparatively in America.

Undrained deposits of peat are found to contain about 90 to 95 % of water which should not be reduced to less than 65 % of the area to be used for agricultural crops. The dewatering of peat materials, especially macerated types and well disintegrated phases of other types to a water content of approximately 25 to 30 % is an essential requirement before they can be used for technical purposes.

No economical and feasible process has yet been found to combat the problem of dessication, and further investigation in the United States is important in every respect.

1061 – **A Method for Measuring the Ammonifying Power of Cultivable Soil.** — PEROTTI, R., in the *Atti della Reale Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIX, Ist. quarter, Pts. 6-8, pp. 251-256. Rome, 1920.

There are two methods of measuring the micro-organic properties of cultivable soil. The first consists in the determination of the action of the micro-organisms in solutions inoculated with a limited weight of soil, whilst in the second the same action is determined by adding a limited volume of solution to a soil sample.

The use of solutions for the study of the vital properties of the soil has been long known and is even now the most widely-used method, but the results obtained have not always been accepted as accurate. The author has tried therefore to control this method rigorously in order to ascertain its accuracy. He now describes his researches with the object of determining the best conditions under which the ammonifying power on fertile soil can be measured by means of solutions.

The best conditions, according to the author are as follows: — Place 10 cc. of a 1.5 % solution of peptone in a test-tube and add 5 cc. of a mixture of 50 gm., of earth in 500 cc. of distilled water. This is placed in an incubator at 20 to 25° C and after 4 days the amount of ammonia produced is determined by distillation with calcined magnesia.. The average of four determinations is taken for each test.

1062 – **Cultural Studies of Species of Actinomyces.** — WAKSMAN, S. A., (Department of Soil Bacteriology, New Jersey Agricultural Experiment Station) in *Soil Science*, Vol. VIII, No. 2, pp. 71-215, pl. 4, Bibliography of 47 works. Baltimore, M. D., Aug. 1919.

The actinomycetes form a large and important group of micro-organisms both in number and activity. They have been isolated from wounds, air, water and foodstuffs, but chiefly from soil (1). The author has made a study of the same as regards the origin, nomenclature, and classification into groups, the representatives of which have common morphological, physiological, and cultural characters. He has identified 41 species of *Actinomyces*.

(1) See *R.* 1919, No. 428. (*Ed.*)

1063 - **Nitrogen Fixation, Ammonification and Nitrification on Embanked Soils in India.** — See No. 1074 of this *Review*.

1064 - **Field Comparison of Hydrated Lime with Limestone of Different Degrees of Fineness.** — HARTWELL, BURT. L., and DAMON, S. C., in the *Agricultural Experiment Station of the Rhode Island State College, Bulletin* No. 180 pp. 4-18, figs 4, tables 4, Kingston, Dec. 1919.

A comparison was made between slaked and hydrated lime which contained 50.99 % calcium oxide and 22.43 % magnesium oxide, and 10-mesh ground limestone from the original rock. The following siftings also entered into the comparison namely 10-20, 20-40, 40-80 meshes. On certain plats the ground limestone was used in an unsifted condition. Applications were made on the basis of equal neutralising value, Beets carrots, alfalfa and barley, all sensitive to soil acidity were grown on assigned sections of a dry gravelly loam to test the possible cumulative effect of this acidity wich would be reflected on the growth of barley, this being finally cultivated over the entire area. Fertiliser ingredients were employed to maintain as far as possible the initial acidity of the check or unlimed plats.

The regular application of lime in whatever form was equivalent to 1 200 lb. calcium oxide per acre. Only in certain cases, three times this amount was applied, and in no case in sufficient quantities to neutralise completely the large amount of soil acidity.

Effect of the lime on the different crops, considered collectively. — The relative response was as follows: beets 4.4, carrots 2.6, alfalfa 1.9, barley 1.6. More acid soil was evident during the sixth year with barley grown over the entire field and with lettuce grown in pots. When the acidity was reduced, the four crops affected succeeding crops comparatively uniformly. During the first season the 80-mesh limestone had the same growth effect as the hydrated lime, and practically the percentage of this grade contaned in the 10-mesh limestone was a measure of the efficiency of the calcium oxide equivalent of the unsifted material for the crop immediately following its application. The fine material first entered into the reaction, and had the effect of greatly lessening the attack on the coarser particles.

Where lime is much needed, about 2.5 parts in weight of ground limestone depending upon its fineness is required to exert the same first effect as one part of hydrated lime.

The experiment showed that there was practically no difference in the average effect during a period of years between the 80-mesh and the coarser unsifted limestones. The effect of the 10-mesh limestone was greater than the equivalent amount of hydrated lime, but the greater activity of the latter in the first years placed the average slightly in its favour.

A selection of these two kinds of lime according to the authors shoul depend mainly on the relative cost per calcium oxide equivalent delivered on the land. There are many indications that it is not economical except for certain quite sensitive crops to neutralise entirely the so-called soil acidity. It is advised under many conditions to make a rather small application of an active kind of lime for the crop especially requiring

attention, and then to apply more a little later when a similar need arises arises (1).

1065 - **The Influence of Lime on the Nitrificatcn of Farmyard Manure in Arable Soik** — BARTHEL, C. and BENGTSSON N. (Central Agricultural Experiment Station, Stockholm, Sweden) in *Soil Science*, Vol. VIII, No. 3, pp. 243-258, bibliography of 10 works, Baltimore, M. D., September 1919.

It is well known that the part of nitrogen in solid manure that is first nitrified in the soil is the ammonia nitrogen, but only a part is nitrified during the 1st year of growth, even under the most favourable conditions. Hence the desire to ascertain whether the fertilising action of the manure could be enhanced by the application of any of the chemical fertilisers easily obtainable.

The first factor considered was lime, and a record was kept of the exact methods adopted. The following ingredients were mixed with the soil : 1) ammonium sulphate, ; 2) sulphate of ammonia and calcium carbonate ; 3) farmyard manure ; 4) manure + lime ; 5) no admixture (control). The various mixtures were then placed in glass jars holding 5 kg., each, and these were then sealed down to prevent evaporation. At regular intervals samples were analysed for their content of nitrate-nitrogen, ammonia-nitrogen and moisture.

All the experiments tend to show that on the addition of lime in the form of calcium carbonate, and farmyard manure to cultivated soil of both neutral and acid reaction, no favourable action of the lime on the nitrification of the farmyard manure resulted, but on the contrary an impeding effect occured in the cases v here the lime was applied in large quantities, larger probably than that applied in ordinary practice.

It is not easy to explain the cause of the impeding action of lime, but at any rate, it may be concluded that the lime does not have either an impeding or stimulating action on nitrification of the manure in the soil when supplied in recognised quantities.

1066 - ***Sesbania sericea* as a Green Manure Crop.** — *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 7, pp. 282-254, fig. 1 London, 1920.

Specimens have been received at Kew sent by J. S. DASH, Director of the Agricultural Station Guadeloupe, West Indies, of a leguminous herb characterised by silky leaflets and straight very narrow pods which were found growing wild on an islet in the harbour and were put under experimental cultivation as a possible green manure crop. The plant proved to be *Sesbania sericea* D. C. The following details were also forwarded : the nodules on the roots are in size and quantity superior to those of any other leguminous plant. The plant seems capable of reaching a height of 4 ft., or more in good moist soil, but then has a natural tendency to become woody, and the time for turning in as a green manure crop should be judged accordingly. Sown thickly it will produce a heavy yield of green material when 2 to 2 ½ ft high.

(1) See *R.* Feb. 1920, No. 176. (*Ed.*)

Analysis of the Plant %.

In *stems* only: Moisture 69.17; albuminoids 3.69 (0.59 nitrogen); amides 1.39 (0.25 nitrogen); mucilage 3.50; cellulose 5.80; woody fibre 14.27; ash 2.18 (phosphoric anhydride 0.24 in stems and 0.29 in roots and potassium oxide, K_2O, 0.20 in stems and 0.20 in roots).

Total nitrogen 0.84 in stems and 0.83 in roots.

	Kilos per hectare	N.	P_2O_5	K_2O
Stems	14 103	1.18	34	28
Roots	1 710	14	5	3,5
Total . . .	**15 813**	**1 32**	**39**	**31.5**

There are in the Herbarium, specimens from the following places, and the former information might be used advantageously there: *West Indies*: Porto Rico, sea shore and Mayaguez; moist fields near Anasco. Jamaica; on the road from Kingston to Spanish town: Bahamas, near Nassau, *British Guiana*: sea shore. *French Guiana*: Cayenne. According to URBAN (*Symb. Antill. IV.* 286) it occurs also in Hispaniola, St Thomas, Antigua and Martinique. A single gathering has also been made in Ceylon, near Colombo.

On the west coast of Africa there is also what appears to be almost an identical species, namely *Sesbania pubescens*. This occurs in marshy places from Senegambia to Lake Chad, and on the shores of St Thomas Island.

In western Australia found at Flinders River, Sturts Creek, Depuch Islands and between the Ashburton and De Gray Rivers, is another plant which scarcely seems specifically distinct from *S. sericea*, and named by BENTHAM, *S. aculeata* Pers. var. *sericea*. There seeems no reason why in both cases the species could not be used as green manure.

1067 – **Tobacco Oil Cake as a Fertiliser.** — See No. 1107 og this *Review*.

1068 – **Studies in the Chemistry of Sugar Cane.** — VISWANATH, B., in *Agricultural Journal of India*, Vol. XIV, No. 3, pp. 440-457 charts 2, tables 5. Calcutta, 1919.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS

The author has devised a method of extracting and examining small quantities of juice from sugar cane, without harming the cane to any appreciable extent. The sharp open end of an ordinary hypodermic needle was plugged with molted tin, and a small hole was bored in the side of the needle. The needle when inserted in a slightly slanting position into the internode, ruptures the neighbouring cells during its passage and two drops of juice from these cells pass into the needle by the side hole. This only permits the determination of the index of refraction of the sample of juice and the deduction therefrom of the percentage of total solids calculated as sucrose (ABBE refractometer).

By this method the author was enabled to determine the total sugar content of each point of the sugar cane during the various stages

of its growth, thus obtaining a glimpse into the life-history of the cane. The following condlusions have been drawn : —

In a young cane the maximum amount of total sugars is found at the basal joints. As the cane becomes older the maximum sugar content moves higher and higher till it is at the highest dead leaf joint.

A large increase of sugars occurs in the internode after the death of its attendant leaf.

It appears that the formation of sucrose in the cane is not due to such a simple process as the direct polymerisation in the stem of reducing sugars translocated by the leaf.

1069 – **Chemical Composition of *Desmodium leiocarpum* and *D. triflorum*.** — See No. 1097 of this *Review*.

1070 – **The Crescograph, a New Apparatus for Studyng the Growth of Plants.** — Bose, J. C. (Calcutta University), in *La Nature*, No, 2423, pp. 161-165. Paris, Sept. 11, 1920.

The Study of plant growth is a subject of extreme practical importance, for the nourishment of the world depends closely upon the growth of plants. The movement of stalks, leaves, and roots under the action of light, heat, and pressure are often due to small variations in the rate of growth. The discovery of laws bearing on the movements of the organs of growth thus depends on the accurate measurement of the rate of normal growth, and variations from it.

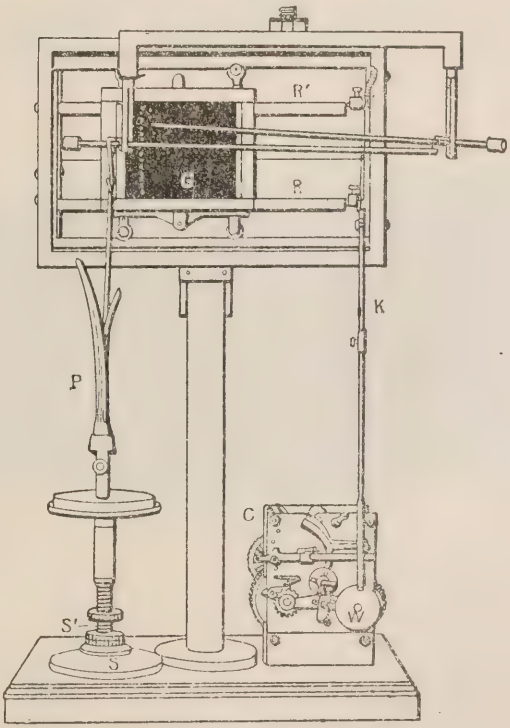
The great difficulty in these researches lies in the extreme slowness of the movements, these being of the order of about 1/40 000, mm. per second, which is about half the wave-length of sodium light. The auxanometers generally used amplify growth about 20 times and therefore several hours are needed before growth becomes perceptible, and, during this time, external conditions, heat and light, are varying the results ; in addition, autonomous variations appear during these long periods. Errors can only be avoided by reducing the experimental period to a few minutes, but for this, amplification must be very great and registration automatic. The author succeeded in doing this with his amplifying crescograph, by means of a system of 2 levers, the first multiplying 100 times, and the second again 100 times, thus obtaining a total amplification of 10/000. The difficulty of obtaining accurate registration of the growth movement, because of the continuous friction of the pen used for registering, has been overcome by an oscillating system, which brings the smoked glass up to the pen at regular intervals (Fig. 1). The registration thus appears as a series of dots at a distance apart corresponding to the length of growth during intervals of one second (Fig. 2*a*).

The graphs can be taken on a fixed metal sheet by means of two points, one in a normal condition before the test, the other after external conditions have been changed Fig. 2*d* illustrates a graph after an experiment, showing the varying distances between the dots which correspond to changes in rate of growth due to stimulation or depression caused by a factor under investigation.

The graphs can also be taken on a sheet moving at a uniform rate, the ordinates of the curves thus obtained representing movement and the abscissae, time.

A factor that increases the speed of growth will send the curve up or, if it slackens growth the curve will bend downnward . (Fig. 2b).

Fig. 1. — *Amplifying Crescograph.*



P = Experimental plant.
SS' = Micronometer Screw fore moving the plant.
C = Clock work movement for producing periodic oscillations of the plate G.
W = Eccentric
K,R,R = Rods governing movement of plate **G**.

Precautions against physical disturbances. — Vibration is best overcome by using a strong table standing on rubber pads, or better still by using a stout shelf fixed to the wall. The author obtained an amplification of one million times with his magnetic crescograph before a London audience, the vibration due to the traffic in the street having no appreciable effect upon the instrument. Fig. 2c. shows the tracing produced on a moving plate by the amplifying crescograph ; a dead stick was substituted for the growing plant, and the absolutely horizontal line showed

not only the absence of growth but also of all movements caused by ex ternal disturbances. There is another element of physical change in experiments on speed of growth which relates to artificial changes in temperature. In order to determine its character and order of magnitude a graph was taken of a dead stick subjected to an increase in temperature, amounting to 10°C. ; the graph shows that expansion of the wood took place up to a certain limit after which the line of dots again became horizontal. The only precaution necessary in experiments on the influence of changes of temperature is to wait a few minutes until the temperature becomes stable.

Fig. 2. — *Graphs.*

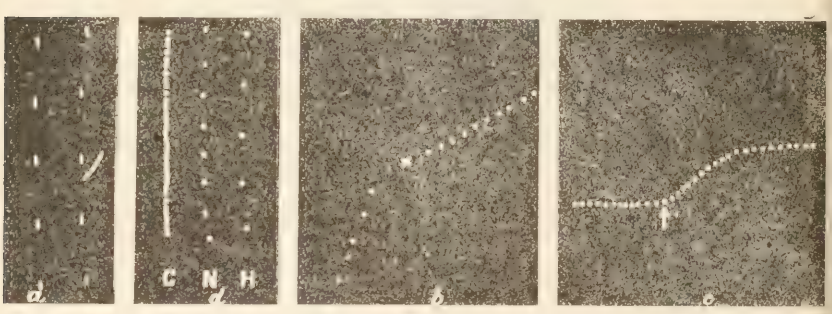


Fig. *a*. — Growth of *Scirpus* sp. at intervals of 1 second amplification 10,000, plate stationary.

Fig. *d*. — Influence of temperature.
N = normal graph.
C = retarded growth due to cold.
H = accelerated growth due to heat.

Fig. *b*. — Registration on a moving plate indicates retardation due to cold.

Fig. *c*. — Dead branch without movement indicates the action of heat.

Elongation due to physical dilatation is very rapid whereas physiological variation is slow and persistent.

Fig. 2*a* shows the rate of growth of *Scirpus Kysoor*, the speed of growth on the graph per second amplified 10,000 times being 9.50 mm. therefore the absolute rate of growth was 0.00095 mm. or 0.95, μ.

Effects of excitants on growth. — The general law has been found to hold good that all kinds of stimulants, mechanical, electrical, or luminous, retard growth, and if their intensity be increased may lead to a complete stop or even a contraction. As regards radiations, all except red and yellow, which produce photosynthesis, modify the rate of growth. Thus, the author has been able to register the reponse of plants to the long waves employed in wireless telegraphy.

Effects of sub-minimal excitants. — It was unexpectedly found that sub-minimal doses of excitants produced an acceleration of growth in

stead of the retardation caused by average doses. The same effects were observed with electric, luminous and chemical excitants, but, strikingly enough, certain poisons, which, given in normal doses, will kill the plant, cause the plant to grow vigorously and flower much earlier if given in infinitesimal doses.

It is only by discovering the laws of growth that considerable progress can be made in scientific agriculture. The author has only tested a few stimulants, whereas there are thousands that are quite unknown. The empirical methods used in determining the action of certain chemical reagents and of electricity have not always been successful, chiefly, it

Fig. 3. — *Effect of Carbonic Acid.*

The horizontal line in the bottom left hand corner represents the growth exactly balanced. The curve shows the effect of CO_2, dots being made at 10 second intervals.

seems, because proper account has not been taken of the quantity and strengths of the excitants.

THE BALANCED CRESCOGRAPH. — The great sensitivity already obtained with the crescograph has been increased by using NOLL'S balance method, whereby the growth of the plant is exactly compensated by the lowering of the support. A train of years actuated by a falling weight lowers the plant at the same speed as it grows in length, the control of the speed being obtained by means of a screw. When the apparatus is correctly compensated, growth is just equal to the fall and the graph becomes a horizontal line, but it is so sensitive that the slightest external variation will influence the graph either positively or negatively. The speed of growth is indicated by a pointer fixed to the regulating screw. In this way, the author has been able to obtain readings of variations in growth up to one eight-millionth of a centimetre per second.

An illustration of the sensitivity of the method is given in Fig. 3, the excitant used being carbonic acid. An acceleration immediately took place and lasted 2 ½ minutes, being followed by a slackening. With very dilute carbonic acid, the acceleration may last a long time. The author also obtained clear response of a plant to a light of such short

duration as an electric spark lasting about one hundred-thousandth of a second.

THE MAGNETIC CRESCOGRAPH. — There is a limit to amplification by a system of levers, because each additional lever increases weight and friction. In order to obtain greater amplification for certain kinds of research work and for public demonstrations, the author has evolved a magnetic crescograph in which a light magnetic lever moves and rotates an astatically-suspended system to which a mirror is attached; on bringing the pointer of the system and the needle together an amplification can be obtained of from 1 to 10 million times. Some idea of this can be given by imagining the slow crawl of a snail multiplied 10 million times; a shell fired from one of the 15 in. guns of H. M. S. QUEEN ELIZABETH has an initial velocity of 231 ft. per second; the amplification of the snail's crawl is 24 times more rapid. Amplification of 10 million times is obtained with a single lever, and a double lever would increase it another 100 times; giving an amplification of one milliard times. The importance of this apparatus for all kinds of research work is evident. Usually, an amplification of 1 million is sufficient. With ordinary precautions, mechanical trouble can be avoided

The physiological response of a growing plant was shown as follows: — The normal growth was shown by a movement of the spot of light from the galvonometer through a distance of 6 metres in 10 seconds. On introducing chloroform vapour into the bell-jar, the light moved three times as quickly, then came a relapse followed by a slackening of growth and finally a quick contraction, which indicated death The same effects were produced by various poisons, such as cyanide of potassium.

GENERAL PRINCIPLES GOVERNING TROPIC MOVEMENTS. — In plants, the movements caused by external excitants (effects of variations in temperature, attraction or repulsion due to light, diametrically opposed responses of weight to stems and roots, and the diurnal and nocturnal positions of the organs of plants, present such a diversity, that it seems hopeless to try and discover a fundamental reaction applicable to every case. Usually one is content to admit that there are various forms. of sensibilities specially adapted to the individual needs of the plants, but the arguments of teleologists or simply descriptive terms such as the expressions of positive or negative tropisms fail to give a true explanation of these phenomena. The following experimental results seem to make it possible to deduce the general law which governs the tropic movements of plants.

Direct effect of excitation — In the motor yield of the mimosa, excitation provokes a rapid decrease in the turgidity and contraction of the cells. The cause of the decrease in turgidity is not exactly known, but it may be due to a sudden decrease in the osmotic pressure of the cell sap or to an increase in the permeability of the outer layer.

The effect of excitation on plant tissue was shown: — (1) By a decrease in turgidity; (2) the contraction and fall of the mimosa leaves;

(3) negative electromotive variation ; (4) variation in electrical resistance; (5) retarded speed of growth.

Continuity of the physiological reaction in the growing and non-growing organs — The author has found, during his researches on all the methods of excitation (mechanical, electric, luminous etc.) that stop growth or cause an " incipient " contraction, when the intensity of the excitation increases there is immediate contraction, exactly similar to that of the motor yield when directly stimulated. This explains the similarity between the tropic movements in the growing and motor organs

Indirect effect of excitation. — When the excitant is applied at some distance from the motor or growing organs, it produces increased turgidity, an expansion, accélerated growth, an erectile movement in the mimosa leaf, and a positive electromotor variation.

Fig. 4. — *Effects of direct and indirect excitation on growth.*

A. Indirect excitation accelerating growth.
B. Direct excitation retarding growth.

This effect is particularly noticeable in tissues that are semi conductors of stimulations. The opposite effects of direct or indirect stimulation are tabulated as follows. —

Direct excitation	Indirect excitation
Decrease in turgidity, contraction	Increase in turgidity, expansion
Fall of mimosa leaves	Erection of leaves
Slackening of growth	Acceleration of growth
Negative electrical variation	Positive electrical variation

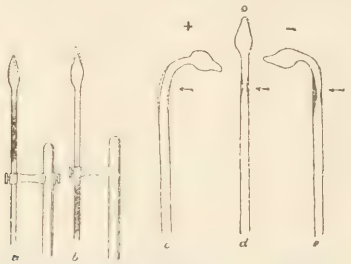
The law can therefore be deduced that direct excitation causes contraction, whereas indirect excitation causes expansion. The same law holds good when excitation is applied to only one side of the organ.

When the excitant acts from the right side (Fig. 5*c*), the side directly excited contracts, and the other side expands, being indirectly excited, so that a positive tropic curvature takes place towards the excitant This explains the twisting of tendrils and positive heliotropism.

Negative heliotropism. — When the light is very strong and of long duration, the hyper-excited organ may react in the inverse direction.

How does this come about ? The author's researches tend to prove that strong excitations traverse the organ and cause a contraction of the opposite side, thus neutralising the primary curvature (Fig. 5*d*). The organ takes up a position perpendicular to the light and this reaction has been termed " dia-heliotropism ".

Fig. 5. — *Effects of direct and indirect excitation.*

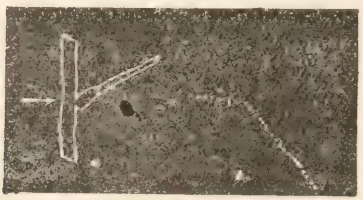


LEGEND :

(*a*) Direct excitation on growing region (shaded), showing shrivelling or contraction (stippled).
(*b*) Indirect excitation (shaded) away from growing region, showing acceleration or expansion.
(*c*) Excitation from the right contraction on this side (stippled), expansion of left (stippled) ; curvature towards the excitant.
(*d*) Transverse transmission through the organ ; neutralisation.
(*e*) Strong, transverse excitation : curvature on the side away from excitant.

In certain cases the transversal conductivity of the organ is considerable ; the result is a contraction of the opposite side, whilst that of the face directly exposed is diminished, because of the fatigue occasioned by a too strong excitation ; the organ, therefore, curves in an opposite direction to the light and shows a negative heliotropism (Fig. 5*e*). These effects are increased when one of the faces is more excitable than the other.

Fig. 6. — *Continued action of light.*



(*a*) Scheme of the result of giving indirect excitation (T) to a mimosa leaf.
(*b*) Graph of the leafs response : erection (descending curve) followed by fall (ascending curve), due to transverse conduction of the stimulus.

Thus it may be stated that the action of continuous light first brings about a movement towards the source of the light, then causes

shrinkage and finally a movement in the opposite direction. Therefore the plant possesses no specific sensitivities, either positive or negative, to the action of light.

The graph shown in Fig. 6 illustrates these phenomena. A ray of light was thrown on a stalk diametrically opposite to an indicating motor-leaf ; the leaf first became erected as turgidity increased. If the excitation is weak and prolonged, the response is erectile or positive only, but if the excitant is strong the leaf droops, owing to decreased turgescence.

Proximal direct excitation	Distal direct excitation
Decrease of turgidity	Increase of turgidity
Concave contraction	Convex expansion
Negative electric variation	Positive electric variation

These results tabulated in brief are as follows :

If the excitation is strong and of long duration it neutralises or reverses the primary response.

[The author's book " *Life Movements in Plants* " Vol. II, deals fully with nyctitropism].

Geotropism. — Another seemingly inexplicable tropism is the opposite effect that weight has on roots and stems. The straightening of a stalk lying horizontally may be due either to the expansion of the lower surface of the contraction of the upper one.

To study this the author used the galvanometric method. The displacement of a stalk from a vertical to a horizontal position is immediately followed by a clear electrical indication that the upper side was excited. The electrical variation increases with the sine of the angle of inclination. This excitation causes the contraction of the upper surface and consequently curvature upwards.

Localisation of the zone sensitive to weight by electrical investigation. — A very thin platinum wire electrode, enclosed in a capillary tube except at the end, was pushed into a stalk in such a way as to enter by one face and protrude through the other ; the galvanometer shows the irritation thus caused to the surrounding cellular tissues. If the stalk is vertical, the galvanometer deflection is slight or nil, if the stalk is displaced towards the horizontal position, the layer sensitive to geotropism shows the maximum irritation and gives a corresponding deflection in the galvanometer ; as the stalk is raised the irritation disappears.

The author has also been able to locate the sensitive layer of the endoderm.

The only anomaly as regards geotropism is the curvature of the roots as opposed to that of the stalks.

Each zone of growth in the stalk is sensitive to weight and movement, geotropic excitation of the stalk is, therefore, direct. This is not

the case in the roots, where the sensitive zone is terminal, whilst the region of curvature is at some distance from the tip. The electrical researches of the author go to show that the root is excited directly, whilst the zone of growth which responds is only indirectly excited. Thus geotropic excitation only acts indirectly on the roots ; then, as the direct and ind rect effects are inverse the responses of the roots and stems are opposite.

The different movements of plants are thus satisfactorily explained by the general law that direct excitations induce contraction and indirect stimuli, expansion.

The author has also shown the extraordinary similarity between the physiological reactions of plants and animals. Thus, this work on the movements of plants forms a chapter on general problems relative to the irritabilities of all living tissues without the study of which the future theories and investigations would be far from complete.

1071 – **Some Factors in Plant Competition.** — Brenchley, W. E. (Rothamsted Experimental Station), in *The Annals of Applied Biology*, Vol. VI, Nos. 2-3, pp. 142-170, Pl. I, figs. 10, tables 16. Cambridge, Dec. 1919.

Up to the present most of our knowledge of competiture influence has been purely empirical and derived from observation and deduction from plants grown under various cultural conditions not under strict control. Consequently little information is available as to the relative importance of the different factors that come into play, when one plant enters into competition with another, or of the interaction between these factors. During the past 5 years a number of experiments have been carried out at Rothamsted which aimed at isolating some of the more important of these factors and establishing their relationship to the growth of the plant.

Pot cultures were carried out with mustard and barley. Results show that the mutual action of one plant to an another when grown in juxtaposition, is a very complex phenomenon. Among the factors which come into play are competition for food, water, and light and also the possible harmful effect to toxic excretions from the roots.

Other things being equal, the total growth as measured by the dry matter produced is determined by the nitrogen supply. rrespective of the number of plants drawing on the resources With limited food supply the efficiency index of dry weight production (1) decreases with, the number of plants.

The decrease in light caused by overcrowding is a most potent factor in competition even when there is abundance of food and water for each individual plant. The effect on barley shows: (1) Reduction in number of ears ; 2) great irregularity in number of tillers produced ; 3) reduction in amount of dry matter formed ; 4) rise in the ratio of shoot to root ; 5) increase in variation in the efficiency indices of dry weight production of

(1) See *B.* January 1920 N° 26. (*Ed*).

a number of crowded plants, lowering them on an average ; 6) decrease in the power of the plants to make use of the food supplied to the roots.

With adequate illumination (in barley) there is a tendency towards the production of a standard type of plant in which the relation between the number of tillers, and ears, dry weights, efficiency indices, and ratios of root to shoot approximates in thin variable degrees to a constant standard. This disappears with overcrowding.

1072 – **Formative Effect of High and Low Temperatures upon Growth of Barley: a Chemical Correlation.** — WALSTER, L. L. (Hull Botanical Laboratory), in *The Botanical Gazette*, Vol. LXIX, No. 2, pp. 97-126. Chicago, Feb. 1920.

The investigation here reported is a study of the effects of high and low temperatures and concomitant variations in the supply of nitrogen, phosphorous, and potassium respectively upon the course of development of the barley plant. A chemical correlation has been established between temperature and nutrition effects.

Method. — The method of sand culture was used throughout these experiments, the sand was pure Ottawa silica sand, and the water content of each jar was approximately 13 % dry weight of the sand.

Tottingham's culture solution was used in diluted form. *Solution A :* potassium nitrate 0.0034 M (0.3437 gm. per litre) + potassium phosphate 0.0108 M (1.4692 gm. per litre) + magnesium sulphate 0.0081 M (0.9750 gm. per litre. *Solution B.* Calcium nitrate 0.0101 M (1.6573 gm. per litre). A mixture of the AB solution is termed " normal ".

Three other solutions were then made up lacking entirely phosphorous, nitrogen and potassium respectively and three more containing only ¼ concentration of these three elements respectively. All cultures were run in triplicate.

About 30 seeds of Oderbrucker barley were sown per culture and the cultures thinned to 25 plants per culture.

Temperature and humidity control. — The greenhouse temperature was controlled by means of automatic thermo-regulators. The lower temperature selected was 15°C and the higher, 20°C. The samples for chemical analysis were taken in mid April.

Some of the differences noted in chemical composition may be due to the higher evaporating power of the air in a warm house. To ascertain, if possible, the character of the internal higher temperature in the presence of high nitrogen supply the WADEMAR KOCH method of tissue analysis (modified by F. C. KOCH) was used.

Comparison Tables were made showing the effect of temperature upon : 1) The amount and percentage of dry matter and water on barley leaves ; 2) the distribution of extractives and insoluble matter ; 3) the accumulation of soluble carbohydrates ; 4) the accumulation of polysaccarides ; 5) the amount of nitrogen, phosphorus, protein and phosphoprotein phosphorus ; 6) the amount and distribution of nitrogen ; (7) the amount and distribution of phosphorus ; 8) the solubility of F_3 nitrogen digested with 1 % Na OH for 48 hours at 37 to 40°C. (F_3 = mate-

rial insoluble in ether, alchohol and water); 9) the solubility of F_3 phosphorus under similar conditions; 10) on the amount of cell wall material etc. F_3 expressed as percentage of total dry weight of leaf.

The experiments reported in this paper, as well as the results of earlier investigators, re pen the question as to just what is meant by an optimum germination temperature. The classical investigations of HABERLANDT on germination temperature place the optimum at the temperature which most quickly permits the emergence of the radicle and plumule; in fact, practically all germination studies have been based upon this as the optimum. These optimum temperatures, at least for the cereals, are evidently too high to insure a future normal development. The writer believes that the course of development is to a large extent predetermined at a very early stage in the development of the plant by the chemical equilibria within the seedling, especially the nitrogen-carbohydrate ratio. These equilibria within the plant, like chemical reaction *in vitro* are conditioned by the temperature and concentrations of the reacting substances. It seems likely that a high temperature and high nitrogen supply at an early stage in the development of the barley plant so shifts the equilibrium toward excessive vegetation as to prevent the normal tendency toward reproduction. Some other factor must be altered therefore, as for example the water supply, if such plants are to be thrown into reproduction.

An investigation of the nitrogen carbohydrate ratio at a different stage in the development of seeds and seedlings furni hed with varying concentrations of nitrogenous compounds will probably throw considerable light upon these questions.

RESULTS AND CONCLUSIONS. — The excessive leaf productions shown at the high temperature is caused by the high concentration of nitrates in the nutrient supplied.

Nitrate nitrogen in the nutrient begins to affect the subsequent course of development at high temperatures at the time of germination, or at least at a very early stage in development. This tendency cannot be counteracted by the addition of phosphorus or potassium salts.

High heat supply + high nitrogen supply in nutrient solution = high soluble nitrogen in leaf + low soluble carbohydrate = excessive vegetation and little culm formation.

Low heat supply + high nitrogen supply in nutrient solution = low soluble nitrogen in leaf + high soluble carbohydrate = normal vegetation and normal culm formation.

1073 – **On the Relations between Growth and the Environmental Conditions of Temperature and Bright Sunshine.** – BRENCHLEY, W. E., (Rothamsted Experimental Station *in The Annals of Applied Biology*, Vol. VI, No. 4, pp. 211-244. London, April 1920.

It is fully recognised that the amount of growth made by any crop in the field, and the rate at which maturity is reached is influenced by many factors such as temperatures, rainfall, season, sunlight, soil conditions and available plant food

It is difficult or even impossible to gain definite information as to the influence of each of these factors on a plant at various stages of growth, and the changes in the actual rate of growth at different periods, from crops growing under normal conditions. There is too great a difficulty in the disentanglement of the intimately associated actions of these factors.

The author has used the method of water culture, as it enables a strict control to be placed on the food and water supplied, and permits of the roots being observed and weighed with far greater accuracy than in soil experiments, and its compactness allows of a large number of plants to be given individual treatment at the same time.

It is also possible to keep a close watch on the temperature variations to which the plants are subjected, and to observe the effect of these variations on a number of individuals at different stages of growth.

Environmental conditions. — The experiments were carried out in a roof greenhouse, and extended over a period of sixteen months from September 1915 to January 1917. It should be noted that light conditions were good for any given period; it was proved by Gregory in experiments on cucumbers near London, in a district subject to fogs, that with high temperatures, light becomes a limiting factor

Artificial heating was installed, and the minimum temperatures kept above freezing point throughout the winter months, so that the results, so far as they refer to the effect of minimum temperatures, are only applicable in cases where the latter do not fall below 32°F. For the whole period of 16 months the prevailing conditions of temperature and light, as indicated by the weekly means of maximum and minimum temperatures, and the weekly hours of bright sunshine are summarised as follows:—

	Mean	Standard deviation
C. Mean maximum temperature	66.5°F	11.7°F
D. Mean minimum temperature	45.9°F	4.66°F
E. Hours of bright sunshine	20.3	16.6

The mean maximum temperature is naturally greatly influenced by the amount of sunshine; the minimum is much less variable, as during the winter months special care was taken to keep the right temperatures at a reasonably high level by means of artificial heating.

The small effect of sunshine on the range of mean minimum temperatures shows that the relatively constant range of mean minimum temperature over prolonged periods is of great importance to the healthy growth of plants under these conditions of life, and that a comparatively slight increase above a certain level is very detrimental.

Method. — At intervals of a few weeks, sets of 160 pea seedlings were put into water cultures Usually two parallel tests were carried out in one of which the nutrient solution was changed weekly and in the other the original solution was retained throughout the experiment. Ten extra seedlings were prepared for drying, to obtain the initial dry

weight of the plants and 10 seeds of the grade used were weighed to give the relation between seed and seedling after germination. At weekly intervals 10 plants were removed and after a cleaning and removing of the roots and shoots separately and when in the fruiting stage, the pods were removed, dried and weighed separately.

With nutrient solutions changed weekly, 8 series of peas were grown. The chief variable factors influencing growth were probably: —

(1) Temperature (maximum and minimum);
(2) Bright sunshine and light intensity;
(3) Humidity of air.

Growth may be divided conveniently into two well marked periods: (1) From the seedling stage till the time that the plant regains its initial weight after loss by respiration; 2) succeeding the former during which the plant is obviously making growth, and which continues till the latter ceases and desiccation sets in.

The length of the first period varies inversely with the mean maximum temperature as the rate of assimilation increases directly with the rise of temperature, up to a certain limit.

Results show that the possible amount of growth depends directly upon the bright sunshine and temperature at all periods of the year, but that beyond a certain point these beneficial factors become harmful and result in the premature death of the plant.

During the first period the rate of growth as shown by the "efficiency index" (the rate % at which fresh material is continuously added to the plant over a definite period) was associated with relatively warm days and nights. During the second period, the rate was associated strongly with sunshine and warm days, but not significantly with night temperatures (never below 32° F).

Results bear out the observations that growth is divided into two distinct periods and that the tendency is for the maximum rate of growth to be attained at the beginning of the second period and to fall off afterwards.

Plants with a restricted food supply make less total growth than those with abundant food, but broadly speaking the response of plants to the environmental conditions is similar whether the food supply is abundant or restricted, though the mean rate of growth is lower when food is scarce. The mean differences in the rate of increase in the presence of abundance and scarcity of food during the second period are strongly significant in favour of the well supplied plants.

During the early weeks, the shoot root ratio falls, owing to the steady increase in root weight, which is associated at first with a decrease and later with an increase in shoot weight. During the second period the shoot increases in weight far more rapidly than the root; and thus the shoot root ratio rises steadily.

Root growth is much affected by low mean maximum temperature and practically ceases from mid November to January, when the mean maxima are consistently below 60° F.

Cessation of root increase is a constant phenomenon and always occurs some time before the shoot stops growing.

Increase in shoot growth is closely associated with rise in temperature.

In a few series the water culture solutions were sampled at intervals, and the nitrogen estimated as potassium nitrate. Results showed at first that the amount of nitrate absorbed by the plant is relatively large in comparison with the dry matter produced, but later more dry matter is formed in proportion to the same amount of nitrate, owing to the accumulation of the products of assimilation.

TABLE. I. — (*Solutions not changed*).

Date	After week's growth	KNO_3 lost from 6 litres solution	Dry weight of 10 plants produced in period	Ratio of KNO_3 lost to dry matter produced over whole period
		grs.	grs.	
Series L:				
April 21st	6	4.02	8.044	1 : 2.00
May 12th	9	5.76	14.887	1 : 2.59
May 19th	10	5.76	15.337	1 : 2.63
Series N:				
May 10th	2	0.96	0.359	1 : 0.37
May 17th	3	1.89	2.520	1 : 1.33
May 24th	4	3.16	7.292	1 : 2.31
June 23rd	8	5.92	23.166	1 : 3.91

TABLE II. — (*Solutions changed*).

Date	At end of week	KNO_3 lost in the week from 6 litres solution	Dry weights of 10 plants produced in the week	Ratio of KNO_3 lost to dry matter produced in the week
		grs.	grs.	
Series K:				
April 14th	5th	2.34	3.176	1 : 1.36
April 21st	6th	1.65	5.738	1 : 3.48
May 12th	9th	3.72	6,650	1 : 1.79
May 19th	10th	4.14	20.984	1 : 5.07
May 26th	11th	3.52	5.847	1 : 1.66
Series M:				
May 10th	2nd	1.29	0.737	1 : 0.57
May 17th	3rd	1.89	2.409	1 : 1.27
May 24th	4th	2.46	2.792	1 : 1.14
June 23rd	8th	4.44	16.509	1 : 3.72

Ratio column of Table I shows that as the plant gets older the increase in dry matter produced becomes less dependant on the amount

of nitrate absorbed by the roots. Also in Table II there is an indication of a similar process though the evidence is less conclusive than where semi-starvation occurs.

1074 – **The Biological Aspects of Wheat Cultivation on Embanked Soils.** — PLYMEN, F. J. (Department of Agriculture, Central Provinces) and BAL, D. V. (Bacteriological Assistant) in *The Agricultural Journal of India* Vol. XV, Pt. III, pp. 289-300. tables IX. Calcutta, May 1920.

It was brought to the notice of the Agricultural Chemist, Central Provinces, that the embanked wheat soils of the Jubbulpore tract were said to be gradually deteriorating and giving low yields. The plants appeared weak and yellow in the early stage of growth but recovered later.

Mechanical analyses indicated that the soil is a heavy sticky clay, black in colour, with a maximum saturation capacity of 60 % by weight, with a soil layer 1cm., deep (HILGARD'S method). It was noted that it gets very hard and forms tenacious blocks on drying after rains.

A biological analysis showed that the soils appear to be very energetic in nitrogen fixation, followed by considerable ammonifying power, but are rather slow at nitrification. Further experiments showed that apparently about 20 to 25 % of moisture in soil is the required amount at sowing time. The nitrifying power increases gradually after rainy weather cultivation. Wheat seedlings from plots receiving this cultivation do not present the sickly appearance mentioned above, and the crop returns on embanked soils are increased. An interesting comparison is made with the black cotton soil of the Deccan undergoing similar experiment, but which is given an open cultivation and experiences a lower rainfall. From the figures quoted it may be noted that the nitrifying power of black cotton soil is very superior to the soil under consideration, even under similar conditions regarding water content, temperature etc. The maximum amount of nitrogen converted into the form of nitrate within a period of 8 weeks was only 50 % (after incubation with cake = 60 mgm. nitrogen per 100 gm. dry soil) compared with 85 % in the case of the black cotton soil.

From the results obtained it appears that young wheat plants in embanked fields are subject to some factor which retards their growth, but it is evident that the cause is removed by cultivation and aeration during the monsoon months. Experiments to determine this factor and also the most economic form of cultivation are now in progress. Former experience has shown the difficulty of using pot cultures in very heavy soils and the impossibility of reproducing field conditions by employing such a method.

1075 – **A Practical Method for Discovering the Free Nitrogen Fixing Power of the Schizomycetes.** — CAUDA, in *Le Stazioni sperimentali agrarie italiene*, Vol. LIII, Parts 1-3, pp. 79-80 Modena, 1920.

For the determination of the free nitrogen fixing power of Schizomycetes, the author suggests a simpler and more rapid method than chemical

analysis; this new method is based on the coloration of the chloroleucites present in unicellular algae. If the algae are grown in a medium containing no nitrogenous compounds, they never become green, even when exposed to the light. *Chlorella vulgaris* and the genera *Protococcus* and *Chlorococcum* are the algae most sensitive to this treatment. When one of these decolorised algae is placed under suitable conditions as regards nitrogenous food, it very soon assumes a green colour.

This property of blanched algae to turn green in the presence of nitrogen affords an excellent test of the nitrogen-fixing power of a micro-organism. Thus, if both are grown together in a medium free from nitrogen, and the algae becomes green, the necessary nitrogen has been fixed by the micro-organism.

1076 – **The Sterility of Hybrids from the Mendelian Standpoint.** — MALINOWSKY, E. in the *Zeitschrift für Induktive Abstammungs und Vererbungslehre*, Vol. XXII, Part. 4, pp. 225-235. Leipzig, May, 1920. PLANT BREEDING

Hybrids between different species of plants are often more or less sterile. This sterility is due to the fact that the pollen grains and the embryo-sacs develop in an abnormal manner, and are incapable of fertilisation. In the case of completely sterile hybrids, all the pollen-grains and embryo-sacs develop abnormally, and no seeds are formed; in that of partly sterile hybrids on the contrary, only some of the pollen-grains and embryo-sacs are degenerate, so that there is a larger or smaller percentage of properly-formed seeds.

In certain cases, the degree of sterility depends on the sex. Thus, for instance, in the hybrid *Antirrhinum siculum* × *A. majus*, all the ovules are sterile, whereas the pollen is active; it is thus possible to fertilise *A majus* with the pollen from the hybrid. The crosses between *Nicotiana Tabacum* (var. *atropurpurea*), and *N. sylvestris* have entirely sterile pollen, and only a few of the ovules are fertile; hence, in order to obtain any seed, it is necessary to have recourse to artificial fertilisation; the pollen of *Nicotiana sylvestris* can be used, if desired. Hybrids between wheat and rye (*Triticum sativum* × *Secale cereale*, behave in a similar manner.

Occasionally some entirely fertile offspring occur amongst the F_2 of partially-sterile hybrids. From *Pisum Palestina* × *P. sativum*, SUTTON obtained only sterile individuals with the exception of 2, which produced a small amount of seed. From these seeds, wholly fertile plants were grown.

In the cross *Stizolobium Deeringianeum* × *S. hassjoo*, BELLING observed, in the F_1, a high percentage of plants with sterile pollen and badly formed embryo-sacs. In the F_2, completely fertile and partially sterile plants occurred in the ratio of roughly 1 : 1, with a slight numerical predominance of the partially-sterile individuals; there were, in fact, 157 of the former and 167 of the latter in one case, and 169 and 229, respectively in the other. BELLING is of the opinion that this partial sterility may be due to the presence in the gametes of 2 genetic fac-

tors, which he calls K and L. If one of these factors is absent, the pollen and embryo-sac develop normally. Hybrids of the F_1 having the genetic constitution Kk Ll, would produce 4 different kinds of gametes: KL, Kl, kL, and kl, of which two, KL and kl, would develop in an abnormal manner, thus being incapable of fertilisation. Only half of the gametes Kl and kL develop normally, and theoretically we should therefore expect to find fertile and partly sterile plants in the same proportion (1 : 1). Such is the hypothesis, which, however, the author proposes to disprove.

TABLE I. — *Zygotes of the* F_2.

AB AB	Ab AB	aB AB	ab AB
AB Ab	Ab Ab +	aB Ab	ab Ab +
AB aB	Ab aB	aB aB +	ab aB +
AB ab	Ab ab +	aB ab +	ab ab +

If it is admitted that the simultaneous presence K and L (K L) causes the abnormal development of the gamete, it is not easy to understand how their absence (kl) should bring about the same result. The biometric data reported do not quite correspond to the ratio 1 : 1, for in either case there is a predominance of partially sterile individuals.

Taking as a basis the experimental data obtained by. BELLING, and also the general results, of his own experiments on wheat hybrids, the author has elaborated another hypothesis which, in his opinion, provides a better explanation of the facts in question.

It is admitted that the partial or total sterility of the hybrids is due to the presence in the zygote, at the same time, of two or more elements that are not in harmony with one another.

Let us consider the most simple case of two elements, A and B. The genetic composition of one of the parents will be **A A b b**, and that of the other **a a B B**. In the F_1, we shall have **A a B b**. These will be the same amount of sterility in all the types of gametes; there will also be fertile **A B** gametes and infertile **A B** gametes. Thus, we shall have fertile gametes of 4 types: — **AB**, **A b**, **a B**, and **ab**. These gametes, on uniting, will produce in the F_2 generation the 16 zygotes given in Table I.

Of these zygotes, 7 are fertile (marked in the Table with a + sign), whilst 9 are partially sterile, given the simultaneous presence of A and *B*.

Instead of the ratio 1; 1, we should have the ratio 9: 7, which is nearer the true one, and also explains the numerical predominance of partially sterile individuals.

Now let us take a more complicated case, in which in addition to **A** and **B**, there are two other elements, **C** and **D**, and where **A** and **C** on the one hand, and **B** and **D** on the other, represent contrasting characters.

The degree of sterility in a plant containing the four factors **A**, **B**, **C**, **D**, will clearly be higher than in the case of another plant having only two factors, such as **A** and **C**. In a similar manner, a plant **A A B B C C D D** will be more sterile than another plant **A a B b C c D d** or one with the genetic formula **A A b b C C d d**.

From **A A B B c c d d** × **a a b b C C D D** is obtained the partially-sterile hybrid **A a B b C c D d**. It must not, however, be supposed that this abnormal development is confined solely to the macrospores and microspores that have a given genetic composition; on the contrary, it may also be found in the macrospores and microspores of all the types. The F_1 hybrid forms 16 kinds of gametes; **A B C D**; **A B C d**; **A B c D**; **A b C D**; **a B C D**, **A B c d**; **A b c D**; **a b C D**; **a B C d**; **a B c D**; **A b C d**; **A b c d**; **a B c d**; **a b C d**; **a b C D**; **a b c D**.

From these gametes, in the F_2, 256 combinations are obtained, of which 49 are entirely fertile and the others are sterile to a greater or less extent. The percentage of wholly sterile and partially sterile individuals in the F_2 increases when the number of incompatible factors exceeds 2. A case of this kind was studied by the author in the offspring of *Tritcum vulgare* Vill × *T. dicoccum* Schrk.

The following crosses were effected:—

No. 1) *Triticum vulgare* ♀ with rather loose ears (local Wysokie Litewskie variety) × *T. dicoccum* ♂ with ears of average compactness.
No. 2) *Triticum vulgare* ♀ (as in No. 1) × *T. dicoccum* ♂ with rather loose ears.
No. 3) *Triticum dicoccum* ♀ with rather loose ears × *T. vulgare* ♂ with fairly compact ears (Solmann's glatter Square-head).
No. 4) *Triticum vulgare* ♀ (as in No. 3) × *T. dicoccum* ♂ with rather loose ears.

No. 5) *Triticum vulgare* ♀ (as in No. 1) × *T. dicoccum* ♂ with ears of average compactness.

No. 6) *Triticum vulgare* ♀ (as in No. 1) × *T. dicoccum* ♂ with rather loose ears.

No. 7) *Triticum vulgare* ♀ with rather loose ears (Zandomir wheat) × *T. dicoccum* ♂ with rather loose ears.

The author determines the degree of the fertility of each plant by dividing the number of seeds by the number of spikelets. Thus for an ear with 20 spikelets and 15 seeds, the degree of fertility is $\frac{15}{20} = 0.7$.

Table II gives the results obtained from the 7 crosses mentioned above :—

TABLE II. — *Results of the 7 Crosses.*

Cross N.	Degree of fertility of F_2 plants															
	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
1	—	3	2	4	1	2	1	1	1	—	—	—	—	—	—	—
2	1	1	2	5	3	2	2	2	4	1	1	—	—	—	—	—
3	—	—	—	—	—	—	—	—	2	3	4	3	3	2	—	—
4	—	—	—	2	—	1	2	1	3	1	0	2	1	1	1	2
5	—	—	—	—	3	—	1	1	—	—	—	—	—	—	—	—
6	—	—	5	2	2	—	3	—	—	—	—	—	—	—	—	—
7	1	4	7	3	1	—	1	1	—	—	—	—	—	—	—	—

From the morphological standpoint, the F_1 of *Triticum vulgare* × *T. dicoccum* presents intermediate characters. In the F_2, on the contrary many new forms made their appearance of which the most important were : *Triticum vulgare*, *T. dicoccum*, *T. Spelta*, *T. durum*, *T. turgidum*, and two other forms, *T. lanceolatum* and *T. ellipticum*, regarded by the author as new species. In the characters of the ear, *T. lanceolatum* resembles *T. vulgare*, but is distinguished from it by its narrower, longer glumes ; *T. ellipticum*, on the other hand, recalls *T. dicoccum*, but the elliptical paleae are twice as long as the glumes. All these forms, which appeared in the F_2, proved to be hereditary.

In the F_2, partially sterile plants were much more numerous than fertile ones, and the percentage of wholly sterile plants was also very high (see Table II).

The numerical predominance of sterile or partially sterile individuals over fertile ones was still greater than in the above-mentioned theoretical data ; hence the author infers that the number of the incompatible characters, factors, or elements, must be still higher.

1077 – **Experimental Studies on Self-incompatibility in Hermaphrodite Plants.** — STOUT, A. B. (New York Botanical Garden), in the *Journal of Genetics*, Vol. 9, No. 2, pp. 85-129, pl. 2. Bibliogr. of 19 publications. Cambridge, Jan. 1920.

Experimental studies of the compatible and incompatible relations of the sex organs (including germ cells) in the fertilisation of hermaphro-

dites continue to yield evidence that these relations are highly fluctuating in the progeny of a single cross or self-fertilised descent. It seems clear that self-fertility is more primitive than cross fertility just as hermaphroditism is obviously the more primitive condition out of which dioecism has developed.

Evidence supporting this general conclusion is given by the author as the results of his own experimental studies of physiological incompatibilities. Experiments were made with the following plants in order to note the relation of vegetative vigour and maturity to variations in self-fertility and self-sterility: *Verbascum phoeniceum; Echscholtzia californica, Nicotiana Forgetiana* (Hyb. Hort), *Brassica pekinensis, Raphanus sativus, Lythrum Salicaria, Linum grandiflorum, Cichorium Intybus* (especially with red-leaved Treviso).

I. The evidence is conclusive that in the various so-called self-incompatibile homomorphic species, there are individuals that are to some extent self-compatible, and that there is among these, wide variability as to the number of sex organs that will function together. This is true at least of nearly all species whose self-fertility has been studied. The same general conditions were found in cases of cross incompatibility within such species.

One family of chicory was studied in detail, and showed grades of vegetative degeneracy, the viability of seeds containing embryos was low, many plants were weak, small and short lived, and many of those that lived, were entirely impotent in respect to the development of stamens and pistils. However there is yet no definite proof that degenerate plants or strains are more frequent in species which show self-incompatibility than in those that do not. The condition in this one family of chicory is like that reported by DARWIN (1869-1877) for the offspring of illegitimate crosses in the trimorphic species *Lythrum Salicaria*.

Perhaps the most significant fact from the standpoint of hereditary analysis is that the proportion of self-fertile to self-sterile plants in the progenies of self-fertile plants seems to fluctuate about a 1 : 1 ratio. This simulates a condition of so-called hybridity or heterozygosity involving selective elimination of the homozygotes. In making such a ratio, however, many grades of self-fertility are classed together. Continued variability and reversibility of characters in inbred lines are best interpreted as marked deviations in quantitative values or potencies of the ultimate units which Mendelian analysis and description may give.

II. Incompatabilities do not arise in species as a condition induced by self-fertilisation and inbreeding.

In considering the fertility of any one stock, the author agrees with DARWIN that there are involved :— 1) The production of perfectly formed sex organs, and 2) the relative functioning of the organs formed. The latter is especially involved in what DARWIN calls "relative fertility", and the former is especially represented in "innate fertility". Experiments proved that there is an extreme type of loss of "relative fer-

tility" in self and cross-incompatibility of plants of such species as *Eschsholtzia californica*, *Nicotiana Forgetiana* and *Cichorium Intybus*.

According to the statement made by East and Park (1918), the number of flowers and fruits is often increased, but no data have appeared which indicate a decreased percentage of non-functional gametes, and there was an increased seed production observed in certain cross-bred progeny due solely to an increase in the number of sex organs.

From this it cannot be definitely assumed that any observed case of decreased productivity in selfed stock involves an actual loss in relative fertility.

At the present time there is no direct or even conclusive indirect evidence that physiological incompatibility with selective fertilisation (at least selective for definite hereditary units) and variations in relative fertilities arise in species as direct results of inbreeding and repeated self-fertilisation.

The evidence from chicory shows conclusively that repeated self-fertilisation in line breeding does not lead to an increase of self-compatibility.

Conditions of incompatibility are not directly induced by repeated self-fertilisation, and are not to be ascribed to the condition of hermaphroditism as such, and this evidence is further proof that variation is operating in the physiological sex differentiation of sex organs.

III. Variations in morphological sex differentiation, especially recognised as phenomena of intersexualism, occur frequently in species prevailing either hermaphrodite or dioecious, and are quite analogous to those variations in physiological differentiation revealed by incompatibilities.

Concerning the relation between seed sterility from incompatibility and sterility from various types of impotence there is much need of further information.

It is characteristic of self-incompatible and cross-incompatible plants that the respective sex organs may be fully developed and potent. As a rule degeneration and impotence in hybrids seem to result from degrees of dissimilarity in the relative constitutional organisation and development inherent in the respective parents. Intersexualism differs from impotence in hybridity in that it exhibits a tendency to be one-sided. In respect to specialisation of the individual as a whole, intersexualism is a period of progressive variation.

There is a decided analogy between the variations in the physiological condition of sex organs as revealed by their relative functioning in incompatibilities, and those variations in the development of sex organs that are recognised under the term intersexualism.

Sex differentiation is hence widely variable in both its morphological and physiological aspects.

IV. Sex determination and sex differentiation in hermaphrodites are fundamentally a process of ontogenetic development, and may occur is various stages of ontogeny. The obvious sex differentiation may begin

in the development of entire branches, of flowers as a whole, or of stamens and pistils of the same flower, and is first strictly a somatic differentiation of like diploid cells. The sexual nature of these sporophytic structures is, however, seen in the intimate part which they play in the production and function of the haploid sex generation.

A self-incompatible plant is itself the result of a compatible fertilisation. Cytoplasmic and nuclear elements of an egg and a sperm fuse to form a zygote highly vigorous and of a high sexual potentiality, yet its sex organs fail to function together. The elements which were compatible in the fertilisation, and in the life of the resulting zygote became incompatible during ontogeny. Yet the incompatibility does not arise simply because of the element of constitutional similarity involved in hermaphroditism, nor because of sex-differentiation as such, for a sister plant with the same parentage and ancestry may be highly self-compatible.

Sexuality is a cyclic recurring condition which makes possible the fusion of cells and nuclei and the pairing of chromosomes. The incompatibilities exhibited in processes of fertilisation are due to physiological properties that are acquired during sex differentiation.

Whether the most successful fertilisation depends on some element or degree of similarity, or on some degree of dissimilarity, or on a proper balance of two, it is clear that the behaviour of incompatibilities both self and cross gives no proof that unlikeness in the sex organs favours the union of the gametes, or that some element of similarity leads to incompatibility.

1078 – **Selective Fertilisation in Pollen Mixtures.** — JONES, D. F. (Connecticut Agricultural Experiment Station, New Haven), in *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 6, No. 2, pp. 66-70 Easton, Pa., Feb. 1920.

The method of mixed pollination in reciprocal applications is considered by the author as the simplest means of accurately testing the efficiency of two kinds of pollen in competition with each other, and experiments were performed with maize to prove the efficacy of this method.

Approximately equal quantities of pollen were collected from a number of plants of two distinct, but uniform types, thoroughly mixed in a bag, and applied to plants with the idea of having from 1000 or 2000 seeds per type. From the twenty mixed pollinations thus made, there resulted 63,694 seeds. There were classified, counted and a sample of each lot grown to test the accuracy of separation. A Table gives full details of the results obtained.

It is evident that in maize there is a pronounced preference for its own kind of pollen, and similar results were given in the case of tomatoes. This is notable in view of the great advantages which hybrid vigour gives immediately to the cross fertilised seeds, and the plants grown from them. In some cases, the weight of cross pollinated seed is increased as much as 50 %. This permits a comparative estimation of the amount of he-

terosis shown by various combinations involving different materials, and signifies a positive correlation between this amount and the preference shown by the plant for its own pollen. As the former is roughly proportional to germinal diversity, this is a remarkable result, because *in proportion as the cross-fertilisation benefits the progeny, the less effective are the germ cells in accomplishing fertilisation.*

In general terms, it has been implied in biological literature that the union of diverse elements, and the resulting lack of balance, stimulates growth. This hypothesis was used in theories of rejuvenation, explanation of hybrid vigour, and speculation concerning selective fertilisation. The author believes that this is not really supported by facts, and that homozygous combinations, according to the present theory, are more efficient than heterozygous combinations of the same factors, also that self-prepotency, except in those cases where a definite process has been developed to prevent self-fertilisation, indicates that unlikeness, instead of favouring fertilisation, is a hindrance. The prepotency of germ cells acting upon the same or similar individuals which produced them, is another indication that homogeneity, in protoplasmic structure is consistent with and favourable to the highest developmental efficiency.

1079 – **Varieties of Wheat from the Cereal Growing Station at Rieti, Italy: – "Sauro" (Soft, Awnless Winter Var.), "Bersagliere" (Soft, Awned, Winter Var.) "Principe Potenziani" (Soft, Awnless, Winter Var.)** (1). — STRAMPELLI, N. in *L'Italia agricola*, year LVII, No. 8, p. 242 + 1 plate; No. 9 p. 262 + 1 plate. Piacenza, August 15 and September 15, 1920.

"SAURO" WHEAT. — Obtained from a natural hybrid of the Japanese white "Shyrobozu" variety, of which the author had received an ear sent from Japan in 1912. It has the following characters:—

Ear red, square, pointed (or pyramidal), average density 29; average number of fertile spikelets 18, minimum 17, and maximum 20.

Spikelets with 3 or 4 fertile flowers (usually 4), average number of seeds per ear about 60, minimum 50, and maximum 65.

Glumes oval. lanceolate, slightly truncated, with distinct keel and small pointed beak, with 2 secondary veins one on either side of the principal vein. The three veins and the keel are fawn-coloured, whereas the glume is red.

Paleae oval-lanceolate, pointed, terminated by beaks or small awns, forming almost a right angle with the axis of the palea. These awns are 3 to 4 mm., in length and may even attain 8 to 10 mm., in the spikelets nearest to the top of the ear.

Kernels wheat-coloured, oval, measuring on an average 6 mm., in length, 2.9 mm., in width and 2.9 mm., in height or dorso-ventral diameter: fracture starchy; weight of 1000 grains 27,81 gm.; 1 hectolitre weighs 78 kg.

Culms 95 cm. high on an average.

Tillering poor.

(1) See: *R.* June-Aug. 1920, No. 732: *R.*, Sept. 1920, No. 851, *R.*, Oct. 1920, No. 956. (*Ed.*)

Ripening : in 1918, sown March 3, harvested July 11 ; in 1919, sown March 8, harvested July 15.

Yield : in 1918, 20 quintals per hectare ; in 1919, 19 quintals per hectare.

" Bersagliere " Wheat. — Obtained from a natural hybrid of the Japanese " Akagomyghi " variety. It is characterised by very early maturity and low habit of growth. Its characters are as follows :—

Ear red, square, slightly pointed ; density 38 ; average number of fertile spikelets 14, maximum number 16.

Spikelets with 3to4 fertile flowers ; on an average, 40 kernels per ear ; maximum 45.

Glumes oval-lanceolate, fawn-coloured, slightly keeled, with triangular, pointed red beak ; red spotted border at side of keel.

Palae oval, pointed, surmounted by awns of which the length varies between 8 mm. and 40 mm., the shortest being at the base and the longest near the tip of the ear.

Kernels of a light wheat colour, oval, slightly spindle-shaped, measuring on an average 5.8 mm., in length 3 mm., in width and 2.7 mm., in height ; fracture starchy ; weight of 1000 grains 28.84 gm. ; 1 hectolitre weighs 77 kg.

Culms 70 cm., in height.

Tillering very poor.

Ripening very early ; in 1918, sown March 5, harvested July 7 ; in 1919, sown March 8, harvested July 11 ; in 1920 (in Rome) sown February 15 and harvested June 9.

Yield : in 1918 and 1919, over 19 quintals per hectare ; in 1920 more than 17 quintals per hectare.

" Principe Potenziani " Wheat. — Obtained by line selection from Japanese wheats. Its characteristics are :—

Ear red, square, density 32, bearing on an average 18 fertile spikelets maximum 20, and minimum 16.

Spikelets with 4 to 5 (usually 5) fertile flowers ; average of 70 kernels per head, maximum 80 and minimum 55.

Glumes oval, slightly keeled or with small beak with large external brown, border, similarly coloured border on side of keel ; and principal vein fawn.

Paleae oval, pointed, with small rostrum and external brown border.

Kernels of fine pale-wheat colour, oval-elliptical, full, with circular section, and slightly concave ventral surface ; average length 6 mm., average width 3.2 mm., maximum dorso-ventral diameter 3 mm. ; fracture starchy ; weight of 1000 kernels 34.46 gm. ; 1 hectolitre weighs 79.5 kg

Culms strong, about 90 cm. high.

Tillering rather poor.

Ripening. — In 1918, sown in the plain of Rieti on March 3, harvested on July 11, before the " Rieti " variety ; in 1919, sown March 8, harvested July 15, at the same time as the " Kiti " sown in October ; in 1920 (in Rome) sown February 15 and harvested June 9.

Yield — In 1918, 29 quintals per hectare ; in 1919 26.81 quintals per hectare ; in 1920 (in Rome), 22.88 quintals per hectare.

1080 – **Determination of Certain Hereditary Factors in a Wild Hybrid of *Phaseolus vulgaris*.** — Sirks, M. J., in *Genetica*, Vol. II, Pt. 2, pp. 97-114. The Hague, March, 1920.

In a plantation of mottled kidney-beans from Prague with an epidermis buff-coloured with violet streaks the author noticed, in 1917, a plant with a dark reddish brown seed coat with bluish streaks. It was evidently the F_1 of a natural cross that occurred in 1916. With the seeds collected from this plant and purely by means of self-fertilisation, a large progeny was obtained in the F_2 and F_3.

An analysis of F_2 and F_3 led to the discovery of the following factors:

(1) **P** fundamental colour factor, necessary for the manifestation of all the colours, no matter what they may be; alone, it gives the buff colour; in the absence of factor **P**, the seed coat remains colourless, even if other colour factors are present.

(2) **G**: — yellow ochre factor which changes the buff colour to pale ochre.

(3) **L**: — deep reddish-brown factor; changes the yellow ochre to reddish brown, and in the homozygous state, becomes dark brown.

(4) **B**: — changes the buff colour to buff violet and the yellow ochre to brownish violet; the factor **L** is epistatic in relation to **V**, which makes it impossible to determine the presence of **V** in the case of the combination **L l** or **L L**.

(5) **Gr**: — grey factor; changes the fundamental colour into greyish buff, the pale ochre into greyish brown and the violet into greyish violet.

(6) **B**: — changes the violet into blue; this factor covers and hides all the others.

(7) **S**: — limits the blue violet, and grey zones to streaks which can be observed in the outer layer of the seed coat and makes it possible to see behind this the buff pale ochre, reddish brown, greyish violet or brownish-blue tints; if the inner layer is violet or grey, the factor **S** still takes effect and renders the violet mottled; the rest of the colours always gives a uniform shade; the factor **S** may be found in the cryptomerous state in the buff coloured, pale ochre, and reddish brown beans on which, however, it has no effect.

Correlations probably exist between some of these factors, as for example between **P**, **V**, and **S** on the one hand and **G**, **L**, **B**, and **S** on the other.

After examination of a large amount of material the author deduced the formula **PPVVSS** for the female type (mottled beans from Prague) and the formula **pp GG Gr Gr vv LL BB ss** for the male type, which when crossed with the former gives rise to the F_1 with a reddish-brown seed coat with blue streaks as obtained by the author in the autumn of 1917.

1081 – **Case of Complete Dominance of a Quantitive Character in Peas.** — Kappert, H. in the *Zeitschrift für Induktive Abstammungs und Vererbungslehre* Vol. XVII, Part. 3, pp. 199-209. Leipzig, March, 1920.

Results of crossing tall peas and dwarf peas from the point of view of such quantitative characters as total length of stem, number of internodes and average length of internodes.

It would seem that we have here a case of the complete dominance of the ordinary or common character (tallness) over the character of dwarfness.

As material for his researches, the author used Laxton's Vorbote, a normal pea 1.20 m., in height, and William Hurst, a dwarf variety growing to about 25 cm.

From the cross Laxton's Vorbote × William Hurst, three groups of hybrids were obtained in the F_2: — (*a*) Dwarf homozygotes; (*b*) tall homozygotes; (*c*) tall heterozygotes.

Had the dominance been incomplete the average length of group *c* would have been less than that of group *b*. In fact, however, the differences in favour of this last group are so slight, that they fall within the limits of error, while in some cases. the heterozygotes are taller than the homozygotes,

Data for 1914.

Type of hybride	Average heihgt in cm.	Average number of internodes	Average length of internodes in cm.
Homozygote.	111.80 ± 3.83	14.60 ± 0.83	7.70 ± 0.28
Heterozygote	111.00 ± 3.60	15.67 ± 0.74	7.15 ± 0.29
Difference . . .	0.71 ± 5.26	1.07 ± 1.11	0.55 ± 0.38

The differences are in any case very small. In this case, the number of internodes is larger in the heterozygote; further, the heterozygote has the advantage as regards average height and the average length of the internodes. In all probability this is a case of the complete dominance of a quantitative (measurable) character.

1082 – **The Heredity of the "Adherent Seeds" Character in Peas.** — MEUNISSIER, A., in the *Journal de la Société Nationale d'Horticulture de France*, Series 4, Vol. XXI, pp. 118-119. Paris, March, 1920.

The variety of pea known as the "caterpillar pea" (pois chenille) which is distinguished by the peculiarity that its seeds when ripe, adhere more or less closely together in the form of a small crown, was obtained from a sample sent to Messrs VILMORIN by M. FROMMEL (Avenches, Switzerland). The peas are round, green. and adherent to one another, the leaves are of an emerald-green colour, The character of "seed adherence" is transmitted unchanged to the offspring.

The first crosses were made in 1908 by P. de VILMORIN, between a pink flowered variety ("pois de momie"), and a pea with white flowers ("Emereva"),

In the two crosses, the seed adherence disappeared entirely in the F_1, In the F_2, a small proportion of the seeds was united together. The in-

dividuals possessing this character transmitted it without exception to all their descendants.

Thus seed adherence is a recessive character,

By means of successive crossing, it was possible to introduce this character into several distinct varieties in correlation with the most different characters (absence of tendrils, fasciated stems, soft pods, etc.), and to obtain " chenille " peas with round, white seeds, or with wrinkled, grey or red seeds, etc.

There is, however, always complete correlation between the two characters " seed adherence ", and " emerald green leaves."

The proportion of adherent seeds varied much according to the season, therefore not only hereditary factors, but also environment have an effect upon this character.

The following are some of the data concerning the number of adherent seeds in certain plants manifesting this peculiarity in a special degree: —

In a plant with green, round seeds, there were two chains of 8 peas, one of 7, two of 6, one of 5, one of 4, one of 3, three of 2, and 5 free seeds,

Another plant, with round white seeds, had two small crowns of 8 peas, one of 7, one of 6, two of 5, one of 4, ten of 3, ten of 2, and 14 free peas.

Finally, in one plant with spotted, fawn-coloured seeds, there was one series of 8 adherent seeds, one of 7, one of 6, two of 5, two of 3, two of 2, and 2 free seeds.

1083 - **Heredity of the Colour of the Hilum of the Seed of *Vicia Faba*.** — Sirks, M. J., in *Genetica*, Vol. II, Pt. 3, pp. 192-199. The Hague, May, 1920.

Plants with black hilums that were probably heterozygotes (appearing amongst white hilums) gave on self-fertilisation a mixed progeny of blacks and whites in the ratio of 3 : 1. Black is therefore the dominant character.

Plants which had flowered freely showed in their progeny the effect of spontaneous cross fertilisation. Thus the progeny of certain plants with a black hilum gave a numerical ratio very different from the normal ratio 3 : 1, whilst, amongst the progeny of plants with a white hilum, seeds with black hilums appeared sporadically, which is evidently due to a spontaneous cross.

1084 - **" 2714 POJ " and " 2725 POJ " New Javanese Varieties of Sugar Cane obtained by Crossing; Their Introduction into Cochin-China.** — Erkelens, F. A. (Directeur de l'Office Agricole, Industriel et Commercial Indochinois), in the *Bulletin agricole de l'Institut scientifique de Saïgon*, Year II, No. 9, pp. 278-282. Saïgon, September, 1920.

The extraordinary industrial and cultural results obtained by crossing different varieties of sugar cane have encouraged investigations to create new and still more rich hybrids.

In this connection, special mention should be made of the years 1917, 1918 and 1919 (especially 1917), for during this period of intense activity, many new varieties were obtained. Of these, the most interesting are

2714 POJ, and 2725 POJ, obtained in 1917 by MM. VAN HARREVELD and JESWIET at the "Proefstation Oost Java" (1). They have been studied at the Pasoeroean Scientific Institute, and have had considerable success in Java, where they have spread with great rapidity.

The author has presented to the Scientific Institute of Indo-China a certain number of cuttings he collected during his recent visit to Java. These were consigned to M. VIEILLARD, the Director of the Laboratory of Genetics and Selection of the Institute, and he had them planted immediately at the Phu-My Station in order that they might increase and that their adaptation to the rich soils of Cochin-China might be studied.

At the beginning of the study of the improvement of sugar-canes by crossing it was found necessary to make crosses between wild varieties and ordinary or selected cultivated ones. Later, however, it was possible to create much more complex hybrids starting from the old hybrids and determining the grouping and even the proportions of their respective essential characters.

Thus, the sugar canes 2714 POJ and 2725 POJ (which were the subject of the present work) have both come from seeds obtained by crossing 2364 POJ with E K 28. Their pedigree is therefore as follows:—

2714 and 2725 POJ
- Female parent 2364 POJ — *Cross* — 100 POJ × wild cane Kassoer
- Male parent EK 28 — *Probable Cross* — Bandjer masinhitam × Fiji cane

Cane 100 *POJ* is a dark-red hybrid Borneo × Lonzier (2); it has a high sugar content, and occupies about a tenth part of the area under sugar cane in Java.

The wild cane, Kassoer, was found by SOLTWEDEL at the foot of Mount Tjerémé in the Cheribon Residency, Java. The seed obtained by self-crossing did not produce offspring with fixed characters, which proves that we have here to do not with a pure variety, but with a natural hybrid, probably black Chéribon × Glagah (*Saccharum spontaneum* L.).

It is interesting to note that the wild Glagah cane is extremely resistant to "sereh" (3) and has hitherto always transmitted this character to its progeny, no matter with what variety it has been crossed. The Kassoer cane, which, as has been said, is probably a hybrid, also possesses this valuable character, and to such an extent that all inoculation experiments with this disease have had no effect either upon it or its hybrids.

Unfortunately, the Glagah cane contains no sugar and Kassoer but very little, so that the direct hybrids from these parents have not been able to pass the industrial test (with the exception, however, of Tjepiring 24,

(1) Many varieties of sugar cane are distinguished by a number followed by the initials of the names of the Stations where they have been obtained. Here, the letters P. O. J. are the initial letters of the Words "Proefstation Oost Java" (*Ed.*)

(2) See *R.*, Oct., 1920, No. 983 (*Ed.*)

(3) See *R.*, Oct. 1920, No. 983 note, (2). (*Ed.*)

the result of the cross black Chéribon × Kassoer ; but this hybrid is daily losing favour with sugar-cane growers, and now only occupies one per cent. of the area under cane in Java).

As the hereditary resistance of these varieties was considerable, especially against " sereh," it was possible as well as necessary to dilute still further the Glagah and Kassoer element by successive crossing with varieties rich in sugar, so as to obtain a hybrid with a high sugar content and also sufficiently resistant to disease. Thus the new varieties 2714 and 2725 POJ only contain ¼ of the Kassoer element or ⅛ of the Glagah element,

The *Bandjermasin-hitam cane* owes its name to a Javanese word whose literal meaning is " Capital of Black Borneo " (1). It is called by the Dutch, the " dark-red Borneo cane." This variety has been used in the creation of several hybrids ; it is, for instance. the female parent of Cane 100 POJ.

The *Fiji cane*, of " dead cane." has been used in the creation of several excellent hybrids, two of which are 247 *B* and 247 POJ. It is a variety that has long been known in Java, where it was growing as long ago as 1891 on the plantations of Toelangan and Kremboeng (the Residency of Sidhoardjo, Java).

Thus 2364 and E K 28 are hybrids of these original varieties, some of which are themselves probably hybrids (2), whereas the new varieties brought to Saïgon by the author are both, as has already been pointed out, different products of the same cross, obtained in the first place from the above hybrids.

Their respective characters are as follows :—

Characters of Cane 2714 POJ. — *Stalk* :— Olive-brown, later brownish-yellow, like cane 100 POJ, but thicker.

Internodes long and straight.

Leaves grass-green, wide, very long, first erect then bent, with long thin apex.

Tuft with many shoots, and of rapid strong growth. The composition of the sap of the base and different parts of the stem is as follows :—

	Brix degree corrected	Saccharose Per cent.	Coefficient of purity	Extractable Saccharose Per cent.
Base June 18, 1918	19.2	17.4 ×	90.4	16.6 ×
Base June 3, 1919.	21.7	20.3	93.5	19.7
Middle, June 3, 1919.	20.9	19.6	93.6	19.0
Extremities, June 3, 1919	18.3	15.8	86.3	14.8

(1) Bandjermasin is the capital of the Dutch part of the island of Borneo.

(2) The hybrid character of E. K. 28, which is now the favourite sugar-cane in Java, was long unknown, and has only quite recently been established by the Pasoerean Scientific Institute. (*Author's notes*)

Different formulae have been suggested for the calculation of the saccharose that can be extracted industrially (1). Formerly, the extractable saccharose was estimated by the following formulae :

$$SE = 2 \text{ Saccharose} - \text{Brix}, \text{ or } SE = \text{Saccharose} \times \left(2 - \frac{100}{\text{coefficient of purity}}\right)$$

It has, however, been found that, owing to improved manufacturing methods, and to stricter chemical control, the figures given by these formulae are a little too low. Therefore, new formulae have been devised, including that proposed by Dr. ROSE and Dr. PRINSEN GEERLIGS, viz.,

$$SE = \left(1.4 - \frac{40}{\text{coefficient of purity}}\right) \times \text{Saccharose}$$

which has been used for obtaining the figures given in this article.

Other useful formulae have also been suggested, such as those of CARP. HAZEWINKEL and Dr. WINTER mentioned by the author. The formula selected depend upon the degree of purity it is desired to attain in the final product (2).

CHARACTERS OF CANE 2725 POJ, — *Stem:*— yellowish-green, later light-yellow, same structure as that of preceding cane.

Internodes like those of preceding cane,

Leaves bluish, very wide, bent.

Tuft numerous shoots, with rapid, strong growth.

	Brix degree corrected	Saccharose Per cent.	Coefficient of purity	Extractable saccharose Per cent.
Base, June 18, 1918.	21.4	20.1	93.8	19.5
Base, June 3, 1419.	21.9	20,8	94.8	20.3
Middle, June 3, 1919.	21.4	20.2	94.5	19.7
Extremities, June 3, 1919	19.5	17.3	88.8	16.4

These two varieties had been planted in the nursery on June 17, 1918, so that they were out a year old at the time of the last analysis the data of which are given above. They are therefore early varieties.

Their susceptibility to root-rot, which cannot be very great, will be definitively determined by the study of large plantations,

The Pasoeroean soils on which these canes thrive are clayey, and this makes it probable, that both the varieties in question will grow on a large

(1) In France it is assumed that 1 part of glucose prevents the crystallisation of 2 parts of saccharose, and that 1 part of ash prevents 4 parts of saccharose from crystallising. Thus the amount of saccharose, glucose, and ash present is determined, and the amount of glucose is multiplied by 2, that of the ash by 3 ; the products of these 2 operations are added, and the total amount of saccharose subtracted. The figures thus obtained give the refinable saccharose. (*Note by L'Institut Scientifique de Saïgon*).

(2) In order to determine this, the percentage of foreign elements which can be permitted to remain in the mixture can be added to the SE figure. (*Note by L'Institut Scientifique de Saïgon*).

number of soils. It is to be hoped that the results obtained on the very rich soils of Cochin-China will not be inferior to those obtained in Java.

1085 – **Selection and Crossing Experiments with a View to Obtaining New Varieties of Tobacco Resistant to *Phytophthora Nicotianae* de Haan, in the Dutch East Indies.** — D'ANGRENIOND, A. in *Proefstatjon voor Vorstenlandsche Tabak, Mededeelin's*, No. XXXVII, pp. 1-20 Semarang, 1919.

The different varieties of tobacco grown in Java are very divergent as regards their resistance to *Phytophthora Nicotianae* de Kaan. Artificial infection experiments carried out on 138 different varieties furnished the following data (the figures in brackets give the percentage of seedlings still alive 30 days after infection).

Timor gebobbeld (84.6) ; Timor glad (40.5) ; Santiago de los Caballeros (94.6); Havana Criollo (82.2) ; Vuelta Abajo (78.4); Cuban Seed-leaf (73.5) ; Connecticut River (82.5) ; Stewart Cuban (89.1) ; Okinawa (85.5) ; Cuban (67.8) ; Satsuma (49.4) ; Cuba (66.9) ; Kanari (0) ; Yo 10 (0) ; Hatano (0) ; Matsukawa (0) ; Bajesi (0) ; Kokubu (0) ; Kanari Satrian (0).

Santiago de los Caballeros, Timor gebobbeld, Stewart Cuban, Okinawa, and Havana Criollo are especially distinguished among the 138 varieties studied for their great and well-marked resistance to *Phytophthora Nicotianae*. None of them, however, owing to the inferior quality of their product, could be used as a substitute for Kanari, or Yo 10, which are great favourites on account of the excellent quality of their leaves, but are unfortunately very susceptible to *Phytophthora*.

Many crosses have been made between the resistant and non-resistant varieties enumerated above. The following are data respecting their descendants in the F_1.

F_1	Percentage of surviving seedlings	F_1	Percentage of survivings seedlings
Kanari × Timor geb. . . .	45%	Hatano × Timor geb. . . .	70%
Kanari × Okinawa	26	Hatano × Okinawa	81
Kanari × Hav. Criollo. . .	25	Hatano × Hav. Criollo . . .	29
Kanari × Vuelta Abajo . .	15	Hatano × Vuelta Abajo . .	41
Kanari × Conn. river . . .	14	Hatano × Conn. river . . .	40

It is interesting to note that the Hatano series of hybrids is more resistant than the Kanari series, although Hatano itself is more subject to the disease than Kanari.

The work is being continued for the purpose of isolating, in the F_2 of Kanari × Timor gebobbeld and Kanari × Santiago de los Caballeros new stable types that combine in the highest proportions the excellence of product distinguishing Kanari, and the *Phytophthora* resistance characterising Timor and Santiago.

1086 – **Studies in the Pollination of the Bartlett Pear in California.** — TUFTS, W. P., in *Agricultural Experiment Station, Berkeley, California, Bulletin* No. 307, pp. 369-390, figs. 8. Berkeley, May, 1919.

In the Sacramento Valley (Davis) and in the Vaca valley (Vacaville), the Bartlett pear is to a certain extent self-sterile, and under foothill conditions as in the Nevada County it is completely self-sterile.

The Bartlett has an exceptionally long flowering period. No cases of inter-sterility have been found to exist between pear varieties, and therefore any variety flowering at the same time as the Bartlett may be used for pollination purposes.

The following varieties can all be employed advantageously to this end: Angouleme, Anjou, Clairgeau, Comice, Dana Hovey, Easter, Howell and Winter Nelis.

Not only did cross-pollination ensure a higher percentage of fruiting buds, but the fruits resulting therefrom did not appear to exhibit the same tendency to fall in June, as those resulting from self-pollination.

1087 – **Pollination Experiments with the Almond in California.** — TUFTS, W. P., in *Agricultural Experiment Station, Berkeley, California, Bulletin* No. 306, pp. 337-336, figs 15. Berkeley, March, 1919.

Report of a series of experiments carried out with a view to solving the following problems:—

1) What varieties of almonds commercially grown in California will prove profitable when planted in solid blocks, *i. e.* without pollenisers? This is a question of self-fertility.

2) What varieties planted in solid blocks will not be profitable? This is a question of self-sterility.

3) Admitting that the almonds at present grown in California will not prove profitable without providing for cross-pollination, which varieties should be planted together? The following points should be considered in selecting varieties:

a) Commercial value of the polleniser.

b) Simultaneous flowering periods of the polleniser and the variety to be pollinated.

c) Ripening periods of each variety.

d) Amount of pollen produced by the polleniser

e) Germination capacity of the pollen produced by the polleniser.

Results may be summarised as follows:

1) Satisfactory artificial germination of almond pollen was secured in 12 % a cane sugar solution.

2) The varieties studied may be divided into early and late flowering as follows: *Early flowering*: — Big White Flat, California, Harriott, I. X. L., Jordan, King, Klondike, Lewelling, Ne Plus Ultra, Nonpareil, Peerless, Princess, Silver Shell. *Late flowering*: — Dickinson, Drake, Eureka, Golden State, Languedoc, Nonpareil, Reams, Sellers, Texas.

3) With some vareties, the first flowers may give a smaller amount of pollen of inferior vitality to that produced by flowers on the same tree later on.

4) Pollinating agents, such as bees etc., are necessary to ensure good setting.

5) The Harriott variety, self-pollinated in 1916, proved, however, self-sterile the following season.

6) All the varieties so far tested have proved self-sterile, at least in certain years. This list in 1917 included : Big White Flat, California, Drake, Golden State, Harriott, I. X. L., Jordan, King, Klondike, Languedoc, Lewelling, Ne Plus Ultra, Nonpareil, Peerless, Princess, Reams, Texas.

7) Certain varieties are inter-sterile : *e. g.* I. V. L., Nonpareil, Languedoc and Texas.

8) California at present seems to be one of the best pollenisers for all the varieties so far tested, which flower contemporaneously.

9) California may be pollinated by Nonpareil and Peerless.

Drake	»	»	»	California, Languedoc, Nonpareil and Texas.
Harriott	»	»	»	Ne Plus Ultra.
I. X. L.	»	»	»	Ne Plus Ultra.
Languedoc	»	»	»	Drake.
Ne Plus Ultra	»	»	»	California, I. X. L., Jordan and Nonpareil.
Nonpareil	»	»	»	California, Drake, Jordan, Ne Plus Ultra, Peerless, Texas.
Reams	»	»	»	Texas.
Texas	»	»	»	Drake and Nonpareil.

1088 – **Some Variations of the Common Coconut Palm *(Cocos nucifera L.)*.** — Henry, C. (Directur de the Société Française des Iles Marquises), in L'*Agronomie coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year V, 1920-1921 ; No. 32, pp. 52-54, figs. 4 + 1 plate. Paris, August, 1921.

The habit of the coconut palm usually varies very little ; there are always the same large pinnate, more or less erect or drooping leaves, the same annulated trunk, and the same inflorescence in the form of a branch spadix.

The form now in question, however, is very different, it is rather rare and from a morphological standpoint, is worthy of description. Its productive qualities are mediocre, both as regards the number of the nuts and their richness in copra, so it is only interesting as a curiosity. The description of this form is as follows : —

Spadix simple, spicate, from 1 m., to 1.20 m., in length, the flowers occupying about 80 cm., of the total length.

Spathe greenish fawn-coloured, finely ribbed, almost cylindrical, straight, with difficult dehiscence.

Female flowers large, covered with 8 thick bracts from which they emerge when fully open ; they are in groups of 2, 3, and 4 in the upper two-thirds, and are very angular until they open, when they assume the form of

a more or less regular elongated cone, often shaped like a beak. On the lower third of the spadix, they are isolated and filbert shaped.

Male flowers occur either isolated or in the axils of the female blossoms; they are found eclusively on the top 10 cm., of the spadix.

In its entirety, the spadix, before the flowers open, resembles a gigantic ear of maize.

Fruits. — Only a few set (2 or 3 per spadix), and many of the spadices remain sterile. This is perhaps due to the fact that the male flowers open while the spathe is still closed and the female flowers are hidden within their bracts. The fruit is oval, irregular, excentric, 16 cm. in its longest diameter, and 26-28 cm., in height from the peduncle to the extremity of the terminal beak. This beak is sometimes straight and undivided, and sometimes is curved, ending with a kind of gland; the ribs are scarcely visible; the integument is yellowish-fawn, tinged with brown; there is llttle coir.

Nut of average size, 12 cm., in diameter and 14 cm., in height, ovoid, eccentric, terminating in a straight or curved beak 9 cm. long and of the same consistency as the shell; its tip loses itself in the coir.

Kernel not thick.

Met with occasionally in the Marquezas Islands.

The type of coconut palm introduced into these islands, as far as can be judged from some very old specimens still growing there, had fan-shaped leaves, many thick clusters of nuts, which were large, almost round, with little developed beaks, small amount of coir, average-sized internal cavity, thick kernel, pericarp with coloured integument of a pale reddish brown before it became dry. The coconut palms found there now-a-days have fan-shaped leaves that are erect or drooping; very small medium-sized, or very large, round, oval, or very elongated fruits, varying in colour from white to dark-red, after passing through green and yellow. They have either little coir, or a great deal of it, and the thickness of the kernel is very variable.

These variations are doubtless due to the variability of the genus, though some may be regarded as accidental.

As a result of the atrophy of the central shoot, one coconut palm planted on the sea-shore of the island of Ua-Uka, has become distinctly forked; this tree is twenty years old, its anomalous behaviour dates back two years, and both heads continue to bear fruit. Another coconut palm planted at Atwona (island of Hiva-oa) has an extraordinary peculiarity, its bunches of nuts having all been transformed into shoots; the " peduncle " is of normal length, and at the usual junction of the stalks; there is a swelling surrounded by pinnate leaves. The whole aspect of this tree is most curious.

Another tree produces nuts with coir that is easily detached and very white, even in the case of dry fruits. M. AHUNE, President of the Chamber of Agriculture, has informed the author of the existence in the island of Tahiti of an adult coconut palm with entire leaves.

SEEDS

1089 – **Experiments on the Soaking of Seeds.** — BACHELIER P., SCHRIBAUX, PETIT, LINDET, VIGER (President), in the *Comptes rendus de l'Academie d'Agriculture de France*, Vol. VI, No. 29, pp. 712-719. Paris, Oct. 13, 1920.

According to certain authors the yield of cereals can be increased by soaking the seeds in a solution of potassium nitrate or ammonium nitrate, the theory being that the grain is strengthened and nourished during its period of growth.

M. BACHELIER has experimented with seed soaked for 6 hours in pure water, and in 10 % and 20 % solutions of potassium nitrate or ammonium nitrate.

In 1919, soaking barley grains in pure water assisted the plants to spring up during dry weather. Saline solutions had however a harmful effect, which was greater with ammonium nitrate solution than potassium nitrate, and increased as the solution was more concentrated.

The idea of manuring seeds is not new, and M. DUHAMEL-DUMONCEAU in his *Elements d'Agriculture*, 1760, devoted a long chapter to his experiments on this subject, the results of which were always negative.

M. VIGER remarked on the experiments made by the farmers of the Loiret district who have obtained the same results as M. BACHELIER.

There is no doubt, according to M. SCHRIBAUX, that soaking in a very dilute solution is a help to germination, but the effect seems to be due solely to the action of the water. The effects of solutions and pure water have been compared and the latter generally gives the best results.

M. PETIT mentioned his own experiment which dates back 20 years and said that soaking beet seed in pure water gave good results during dry years, but solutions of fertilisers always gave bad results.

Having made grains of barley absorb sugar, in order to see whether germination was accelerated or not, M. LINDET found that the sugar had no effect on germination. The grain contained enough carbohydrates for shoot formation and it was useless to add any fertilisers to aid germination.

In fact, concludes M. VIGER, all the results show that it is simply the coefficient of humidity of the grain which may be advantageous under certain circumstances.

CEREALS AND PULSE CROPS

1090 – **Experiments with Swiss Jura Wheat in the Vosges District.** — SCHRIBAUX AND PERETTE, J., in the *Comptes rendus de l'Academie d'Agriculture de France* Vol. VI, No. 30, pp. 744, and 746-748. Paris. Oct. 20, 1920.

In regions which have severe winters and where Vilmorin and English wheats are killed by the cold, recourse must be had to the native wheats of which Alsatian wheat comes first in order of importance.

In the Swiss Juras where the winter is just as severe as in the east of France, varieties of wheat selected by M. MARTINET, Director of the Experimental Seed Station at Lausanne, are cultivated. In 1918, M. SCHRIBAUX recommended their trial in France. In a report to the Académie d'Agriculture, M. PERETTE Director of the Agricultural Services of the Vosges, describes the first results obtained in his department, and M. SCHRIBAUX has summarised them as follows: —

In a clay loam of Muschelkalk formation, Vuitebœuf wheat was sown after beet, which had been well manured with farmyard manure and superphosphate. To the wheat was added about 100 kg., of nitrate of soda per hectare. The growth of the wheat was remarkable. Earing took place very early, between May 25 and June 1, which was several days in advance of the Bon Fermier variety. The wheat was harvested on July 24, the earliest in the district. The Vuitebœuf variety was very resistant to lodging and to disease. At threshing time it produced 28 quintals of grain per hectare, which is a higher yield than that of the varieties cultivated locally, *i. e.*, Alsatian red wheat and Bon Fermier. According to M. PERETTE, Vuitebœuf, because of its remarkable precocity, will be very useful in countries with short summers and in mountainous regions.

He remarks also that the seeds had been mixed and contained about ¼ of foreign wheats, which yielded a fairly high proportion of bearded ears.

The other varieties tested, Bretonnières and Blanc de Savoie, are as good as Viuteboeuf, and it is anticipated, will give as good a yield as the latter if sown thick enough; Gavillet is not so good. M. PERETTE reserves his opinion regarding the last three varieties when sown on a restricted area.

1091 – **Notes on Experiments in Wheat Cultivation in Southern Italy.** — MANCINI, C., in *Il Coltivatore* Year LXVI, No. 25, pp. 618-620. Casale Monferrato, Sept. 10, 1920.

The area of wheat under cultivation in southern Italy is very great, being about 40 % of the total cultivated area, but the unit production is very low, averaging less than 8 or 9 quintals per hectare, and in some years, *e. g.*, 1919-1920 not more than 5 or 6 quintals per hectare. This inferiority as compared with the other parts of Italy is chiefly due to natural causes, but these could be eliminated to a certain extent.

The most serious factor which influences the production of wheat in southern Italy is the drought in spring and sometimes even in winter which hinders development and grain formation. Irrigation is the chief means for overcoming this difficulty; it is useful in winter and is always necessary in spring. The following experiment made by the author in 1919-1920 is of interest in this connection. A field 10 ares in extent was divided into three plots, the first one being treated with 4 quintals of superphosphate and 1 quintal of calcium cyanamide per hectare. The second was treated in the same way and irrigated twice between April and May. The third was left untouched and served as a control. The yield per hectare was 12, 20 and 7 quintals per hectare, respectively. Therefore, the fertiliser gave an increase of 5 quintals and irrigation 13 quintals per hectare.

Another experiment on a manured plot served to show the efficiency of single or double trenching, in winter or spring. The results were, *without trenching*, 12 quintals of grain per hectare, *with one trenching* 18 *quintals*, and *with two trenchings* 21 quintals per hectare. With the unmanured plot the weight of the grain was 75 kg., per hectolitre and with the second it was 80 kg.

The wheats cultivated in the south of Italy are of the hard or semi-hard type, and are superior to the soft types because, being earlier, they better withstand the scorching due to heat. The author advises the cultivation of hard in place of soft wheats even in Latium, and he cites the case of two farmers of the Roman Campagna, who obtained a unit yield 25 per cent. greater than that of the best soft wheats.

1092 – **Sowing of Wheat on Rice without Ploughing.** — Novelli, N. in *Il Giornale di Risicoltura*, Year X No. 9, pp. 129-131. Vercelli, Sept. 30, 1920.

Because of the great set-back given to the sowing, ripening and harvest of the rice in Northern Italy in 1920, it is necessary to avoid working the soil when the rainy season has already begun, for that would delay the sowing time which would then be carried out under very bad conditions. As a remedy for this, the author recommends that the wheat should be sown on the rice before the latter is harvested. This system is already widely used in the ricefields in the Provinces of Mantua, Verona, and Bologna.

Theoretically, it is more rational to sow after the ground has been well ploughed so as to assist root penetration, but as late ploughing only compresses and stirs up muddy soil, thus injuring the physical and mechanical conditions and the good state of the surface soil when it is not possible to plough in time and on dry soil, it is better to leave the soil as it is, *i. e.*, already well prepared by the previous cultivation of the rice crop, for by this means it can recover its condition more easily, thanks to perfect surface drainage.

The essential condition for the success of wheat in damp, cold soil such as that on which rice has been grown, is that it be sown at the end of September or beginning of October. The only way to sow the wheat whilst the water on the rice fields is diminishing and the ground still muddy, is to sow amongst the standing rice in the furrows. It is better for the seed to fall on muddy ground, as it germinates more quickly and the roots penetrate more easily. The amount of seed to sow is 20-30 kg., more per hectare than the usual quantity.

By the time that the rice has been harvested the wheat is already green, and after the harvest the furrows should be cleaned and the earth heaped up each side, so that proper drainage, may ensue. Phosphatic and nitrogenous fertilisers should be applied as a dressing in large quantities if possible. In winter, the wheat is also better sheltered by rice straw, but the latter, however, should be cut low. In spring, the ground should be harrowed lightly to remove the straw, and, if necessary, more fertiliser is applied.

In the provinces of Mantua and Venice, very productive wheats are obtained in this way ; weeds are scarce and the only cost of preparing the ground is for manure. Open and strong soils, not too lean, are most suited to this type of cultivation.

1093 – **Cultivation of Rice in Southern Rhodesia.** — MUNDY, H. G. (Government Agriculturist and Botanist) in the *Rhodesia Agricultural Journal*, Vol. XVII No. 3, pp. 243-246 - No. 4, pp. 320-344, Figs. 2 Salisbury, June and August 1920.

During dry years prior to the war, production apparently decreased as a result of the poor crops obtained, but with the advent of a wetter cycle, more native rice has lately been grown, and has led to enquiries as to the possibilities of rice becoming better recognised as a European crop. The information conveyed in the reports on native production made by the Native Department is summarised in this article, and deductions drawn therefrom.

Without exception, low lying swampy soil is selected, and when sufficiently retentive of moisture, the strong black soil (Chiyakwe) is preferred, although much rice is grown on the grey sandy loams (Shapa), or on the black granite vleis (Matoro). Adequate moisture is the governing factor, and not fertility. Although sowings are made on virgin soil, broken up six months previously, they are sometimes made to follow "Tsenza" (*Plectranthus* sp.), or early maize and pumpkins are sown thinly in August and intercropped with rice about October. The pit system is gradually being abandoned in favour of the ploughed ridge and furrow, owing to the preferable moisture holding propensities of the latter method. Deep ploughing in early spring is found sufficient where no moisture conservation is necessary. The date of sowing varies according to the moisture retaining capacity of the soil; October appears to be the most favourable month. The crop is harvested from March onwards. Necessary precautions are found essential with varieties which have a tendency to ripen unevenly and have a tendency to shed grain. From 18 to 20 lb., of seed is used per acre, sown either *in situ* or in seed beeds and transplanted. The average yield is about 5 to 6 bags per acre, but the Native Commissioners of Marandellas and Victoria estimate it as high as 15 to 20 bags. Normally, rice is grown for 2 to 4 years on the same land without manuring, after which new pits or lands are made.

The usual methods are followed with regard to threshing and husking. Unhusked rice is attacked very rarely by weevil compared with husked rice. Wood ashes are sometimes mixed with the grain in the native bins, as a preventive measure.

On the whole there is only a small loss through insect pests and fungoid diseases.

A description is given of the varieties fairly widely recognised, but the author cannot vouchsafe for accuracy, owing to the different names given to the same variety.

At present native rice is grown in practically all districts with a rainfall of 25 inches or more, on land with adequate moisture retaining capacity. However, provided the difficulty of uneven ripening could be overcome, there are considerable areas of wet land, especially in granite formation at present only utilised for early grazing, which should certainly grow rice under European methods of farming. That this difficulty is not

unsurmountable, is noticeable in the subsequent article dealing with rice cultivation in other parts of the world.

II. — The chief producing areas are India, China, Burma, Japan, the Southern States of U. S. A., Egypt, Java, the Philippines, Italy, Spain and Brazil. The larger quantity is of the swamp variety, although upland or hill rice is grown under much drier conditions in China, India and the Malay States, to quite a large extent.

Rice in British India. — The bulk is grown under swamp conditions or under irrigation, and when seed is sown broadcast or in drills, 100 to 120 lb., paddy (unhusked rice) per acre is the usual rate, with a possible yield up to 2000 lbs., per acre.

When the transplanting method is followed which is usually the case where terracing and irrigation is practised, the rate of seeding is only about 30 to 90 lb., per acre, with a prospective yield of from 2500 to 3000 lb., per acre. In this case, the seed bed is thoroughly ploughed either dry or inundated. The land into which the seedlings are transplanted is prepared and treated in a similar way.

Rice in the United States. — This is chiefly grown in the States of Louisiana, Texas, Kansas and California. The first commercial crop in California was grown in 1912 (1). By 1914, 16 000 acres were covered, and three years later, 67 000 acres. The ricefields are mostly terraced or contoured with low banks, and irrigation is practised to a large extent.

About 90 lb., of seed is usually sown per acre, and a crop sown in April matures about September ; the yields vary from 2000 to 3500 lbs unhusked rice per acre.

The land is kept flooded until the rice is 12 to 15 inches high, but the final draining of the land is regarded as of special importance to prevent the uneven ripening of the crop which otherwise will occur.

Conclusions. — Comparisons between these countries and Rhodesia, indicate certain similarities in soil types etc. but point to certain advantages in adopting new lines of cultivation in the latter country, such as terracing and levelling to encourage moisture retention, quite apart from irrigation which will not usually be practicable. Also the importance of draining is evident, as it appears elsewhere to be one method of overcoming uneven ripening. This last factor may be due to the thin rate at which the seed is normally sown, compared with elsewhere, and hints may also be taken in this respect.

During the last three years, Southern Rhodesia alone has imported on an average 1 ¼ million lb., of rice, valued at over £10.000, annually ; from India and Burma. The previous difficulties in preparing paddy rice for market, discouraged all efforts towards growing rice except as a native crop, but a complete rice dressing plant at Salisbury has now been established which has altered the situation entirely.

The Department of Agriculture expects to have by the end of August, supplies of seed of several varieties both upland and swamp, available for

(1) See *R.*, December, 1915, No. 1276. (*Ed.*

distribution under the usual terms of co-operative experiments. These supplies will be augmented by issues of seed which Messrs Marck Harris and Co. Salisbury are prepared to make to intending growers. The imported varieties will probably require one or two seasons before they become acclimatised; native varieties should therefore also be tested contemporaneously.

Rice Milling Machinery. — Particulars were supplied by the manufacturers explaining the process employed in husking and cleaning the grain preparatory to being placed on the market in a form suitable for human consumption. The following is a list of the proceedings:— The paddy after threshing, passes: (1) To the shaking sieve for cleansing operations; (2) to the disc rice huller; (3) to the shaking sieve over a blowing fan to eliminate broken rice particles; (4) to the compartment separator underneath the fanner which separates the paddy from the brown or hulled rice, the paddy being returned to the huller for further treatment; (5) to the white rice pearling cone by means of an elevator (the cone consists of a tapered drum covered with a composition of emery which revolves inside the casing covered with wirecloth). The brown inner cuticle is by this means ground off from the rice, thus producing the ordinary white rice as produced in large mills.

If a finer finish on the rice is required, it is taken into a rice polisher. This is of a similar appearance to the above mentioned cone, but the drum is covered with sheepskin instead of emery composition. The rice is then elevated again into a separator and aspirator and graded into three sizes.

Both the white rice pearling co e and the rice polisher are ventilated by means of a suction fan owing to the advisability of keeping rice as cool as possible whilst milling, to keep down the percentage of broken rice.

The mills are made in various sizes ranging from 5 cwt., to 5 cwt., of finished rice per hour.

1094 – **A Variety of Tripolitan Maize Suitable for Arid Climates.** — ZANON, V., in the *Rivista di Agricoltura*, Year XXX, No. 41, pp. 409-510. Parma, Oct. 8, 1920.

The types of Italian maize seeds distributed to the natives by the Agricultural Office of Benghazi produce plants which have a high and luxuriant growth, but do not set seed. On the contrary, the local variety « sboul-el-blet », in spite of the slovenly native methods of farming, always gives a crop and with careful treatment would give excellent yields.

At Derna, experiments in autumn and winter sowing have proved very successful, even without irrigation and the author considers that the variety mentioned would yield good crops in those parts of Italy which suffer most from drought.

The variety possesses the following characteristics:— Height 1 to 1.5 metres with the root-system well developed; in the young shoots the main root develops quickly and grows deep. The ears are always in pairs and situated at the 5th and 6th node, rarely at the 3rd. An abortive ear occurs at the 4th node The ears obtained by the natives are barely

mediocre, but with careful cultivation, the author always obtained very good ears, a large part of which was perfectly yellow, whereas the grain obtained by the natives is largely red. The ears are about 15 to 18 cm., long and 4 to 5 cm., in diameter, and there are from 15 to 22 rows with 28 to 30 grains in each ; the rows are fairly regular, straight, and parallel.

The colour of most of the grains is a bright chrome yellow. Forty mature grains, dried in the sun after ripening weigh 10 grammes ; the grains measure 7 × 7 × 5 mm. The aleurone layer occupies $^3/_5$-$^4/_5$ of the transverse section of the grain. There is a high content of sugary material both in the grain (hard or soft) and in the pith. As mentioned above, this variety, cultivated at Derna, has given good results, using no other water but rainwater, whereas the natives employ irrigation.

April and September are the best months for sowing in the irrigated gardens of Bengazi. The period of growth varies from 2 to 4 months, according to the time of sowing. If sown on July 1, ripe ears can be obtained by the end of August, and the grain can be crushed after drying a few days in the sun. The natives generally eat the cobs whilst the grain is still tender.

STARCH CROPS

1095 – **Results of Potato Cultivation Trials made at Carrouge (Vaud, Switzerland) at an Altitude of 720 Metres.** — JORDAN, A., in *La Terre Vaudoise*, Year XII, No. 23, p. 222. Lausanne, June 5, 1920.

Potatoes planted on June 20, 1919, in light soil with a clay sub-soil, and dressed with farmyard manure plus a light application of potash and phosphates, gave the following yields :—

Variety	Growth and remarks	Yield on plots 11 m. × 6 m.		
		Small Kg.	Large Kg.	Total Kg.
No. III (Gratiola) . . .	Strong	1.4	19.1	20.5
No. II (Laurus) . . .	Average (mediocre)	2 6	7.7	10.3
No. I (Rindenberg) .	Very Strong	1.5	15.6	17.1
Ursus	Very Strong, Ravaged by field mice	1,0	13,0	14.0

In spite of late planting the results are good ; No. III is worth recommending, the tubers are very regular and marketable ; No. II is not recommended, as there are many small tubers. Ursus, although last in the above table would have yielded equally as well as, or even better than No. III if it had not been attacked by field mice. Certain plants produced from 10 to 12 tubers, some of which weighed 350 gm. No. I variety is good.

The late planting is very instructive, and shows how late a date planting may be done and how, if the crop has been poor, as in 1919, filling up the empty spaces will ensure a good crop.

1096 – **Cutting Potato Tubers for Planting Purposes.** — MOTTOT, S., in the *Journal d'agriculture pratique*, Year 84, Vol. 23 No. 8, pp. 146-147 + 1 fig. Paris, Feb. 19, 1920.

The scarcity and high prices of potatoes during the last few years have brought into prominence the practice of cutting up of tubers for planting. The use of the peel and the eyes gives a saving in seed, but the result is not good, without taking into account the extreme care required and, consequently, the great cost of labour. As regards cuttings, this practice belongs more properly to gardening.

In cutting it is hardly ever possible to get an exact division of the eyes, as the tops are left the greatest number of best developed eyes; it would thus be more simple to cut off the tops and use them only. This method was described for the first time by M. HARRACA during the war. He advised cutting the tops 1 to 2 cm., thick, but the author believes it necessary to leave them about the size of a hen's egg.

The cutting of the tops of the tubers not only has the advantage of utilising the best developed, youngest and most vigorous sprouts for growth, but ensures the tubers being healthy inside.

It is best to cut the tops some time before planting and place them in cool, well-lit, airy sheds. In this way a layer of dried cells forms over the cut portion, which prevents loss of moisture and enables the sprouts to develop more quickly.

1097 – ***Desmodium Leiocarpum*, a Giant Leguminous Forage Plant in Cuba.** — CALVINO M., in *Estación experimental agronómica, Santiago de las Vegas, Cuba, Boletin* No. 43, p. 24, figs. 7 Havana, Aug., 1920.

FORAGE CROPS
MEADOWS
AND PASTURES

Desmodium leiocarpum G. Don (synonymous with *Meibomia leiocarpa*, *Hedysarum leiocarpum* Spreng., and *H. erectum* Vell) grows wild in several districts of Southern Brazil, and is eaten with such avidity by horses that it is known locally as " marmelada de caballo ". Dr. BARRETTO first drew the attention of the Brazilian farmers to this legume and Dr. J. ROSSI, then Director of the Agricultural Station of the State of Santa Caterina Brazil, introduced it into this State some twenty years ago. On returning to Italy, ROSSI, in conjunction with the author, tried to acclimatise *Desmodium leiocarpum* in 1907, but without success, because the plants were destroyed by cold during the winter. In 1908, the author became Director of the " Estación Agricola central de Mexico ", where he experimented with the plant in 1913, using Brazilian seed. The results were excellent, but the Station was suppressed and the results were completely lost. In 1917, the author took charge of the Estación Experimental agronómica de Cuba, where he conducted similar experiments, using seed from the " Secretaría de Agricultura " of the Brazilian Republic. The results were very satisfactory. *D. leiocarpum* is a perennial, with numerous slender, straight stems 4 to 5 metres high, and bearing large clover-shaped leaves. In temperate climates the stems die during the winter, new shoots being formed in the spring, but in hot countries they last several years. *D. leiocarpum* does not appear to be difficult to suit as regards the soil as it grows in Brazil just the same in soils deficient in lime and

phosphoric acid, where other plants would not grow without the help of fertilisers.

When making new plantations it is better to use prepared seed-beds for the seed, which is very small, and to irrigate morning and evening.

Germination in the field takes place in about 20 days or more ; in irrigated land it requires 5 days, and if the seed has been soaked in water before planting, 4 days. When the young plants are 20 cm., high, they should be replanted 50 cm., apart in rows 1 metre apart. Asexual reproduction is difficult but it is possible by taking cuttings from the lower lignified part of the stem. *D. leiocarpum* is a hardy plant and will live even when abandoned for several years, but benefits greatly from weeding and manuring. In localities where it is necessary to protect the plants during the winter, the plant should be cut close to the ground at the beginning of winter, protection being obtained by ridging with a two-furrow plough.

The theoretical yield is 5 kg., per plant at each cutting and, with 20 000 plants per hectare, 100 000 kg., per cutting, or 300 000 kg., for 3 cuttings per annum ; the actual yield is not so great. The plant should be cut before it becomes woody and used green ; the rest is dried in the sun, made into trusses and put into sheds. It could probably be made into silage.

When the forage, whether green or dried, is slightly woody, it is better to chop it before using. Horses and cattle eat it readily.

According to Rossi, the dry forage contains 8.2 % of water. The composition of the green fodder is as follows :— Water, 70.4 %; dry matter, 29.6 % ; proteins, 4.1 ; fibre, 5.05 ; pentosans, 3.4 ; soluble carbohydrates, 1 9 ; insoluble carbohydrates 7.95 ; crude fat, 0.85 ; ash, 3.20

The air-dried plant contains 9.8 % of water and its food value equals 313.16 calories ; forage dried at 100° C. has a food value equal to 347.20 calories.

It is thus an excellent fodder and forms a good supplement to a ration of forage gramineae.

In Cuba, as in Mexico, *D leiocarpum* is exempt from really severe diseases and pests. Amongst the insects that attack it, the author found under the leaves some aphids which were soon eaten by the "cotorrida colorada" (*Cycloneda sanguinea*) an insecti\orous and carnivorous insect which abounds in Cuba. The plant is attacked at intervals by a cottony *Pseudococcus* and by certain *Chionaspis* the first at the centre, the second at the base of the stems. In May, certain larvae eat the edges of the leaves. A fungus of the genus *Diplodia* cause the death of some young plants.

Several other wild species of *Desmodium* are common in Cuba, and the author has found that their root bacteria can live on the roots of *D. leiocarpum* and form numerous nodules.

The author has also searched for other species which might be of agricultural utility.

D. tortuosum of Florida (Florida beggarweed) is an annual, which

grows less than *D. leiocarpum*. The author has grown it with success in Cuba, where it should be useful as a cover crop for the orchards during the rainy season and as green manure in sandy soil. It will even grow in soils that lack lime.

D. hirtum grows well over a large part of former German East Africa from sea level up to an altitude 2125 ft.; growth is rapid and it chokes all other plants, thus protecting the soil from washing and heat. Reproduction from seed is difficult; the seed should be planted in a nursery and the shoots planted out when 10 cm., high.

D. triflorum is a cosmopolitan type of plant hardly 30 cm., high, but it forms thick bushes. M. DE SORNAY advises it as a substitute for clover and lucerne in those countries which are too hot for these plants. It makes good meadows and is eagerly eaten by cattle. The percentage composition of the fresh fodder is:— Water, 64.6; ash, 2.57; crude fibre, 12.39; carbohydrates, 13.79; sugars, 0.93; fat, 0.92; protein, 4.80; calories (ATWATER), 130.809; starch value, 21.23; nutritive ratio, 1 : 5.7.

The yield is not good, however, as the plant is small. The author mentions, as worthy of the notice of the farmers on the high Mexican plateau, *D. orbiculare*, which is known locally as "engorda cabras" (goat fattener), on account of its good qualities as forage. It grows up to an altitude of 1200 to 2400 metres.

In India, *D. tiliaefolium*, a plant of shrubby growth, produces a fibre used for making string and baskets.

D. leiocarpum also yields long strong fibres which could be used for making rope and sacks.

1098 – **Rice Straw as Fodder.** — See No. 1141 of this *Review*.

1099 – **"Marandi" (*Acanthus ilicifolius*), "tivir" (*Avicennia officinalis*) and "lavi" (*Aeleuropus villosus*) Salt Water Fodder Plants.** — See No. 1142 of this *Review*.

1100 – **Food Value of Willow Leaves.** — See No. 1143 of this *Review*.

1101 – **Meadow Top-Dressing Test in New Zealand.** — SCHWASS, C. H., (Fields Instructor-Wanganui), in *The New Zealand Journal of Agriculture*, Vol. XX, No. 6, pp. 369-370, Wellington, 21 June, 1920.

In 1917 an experiment was commenced at Marton for the purpose of ascertaining the respective values of certain top dressing on the typical heavy land in that district. An area of 6 acres of meadow was divided into 6 plots of 1 acre each and top dressed in October as follows: 1) Control, no manure; 2) carbonate of lime, 1 ton; 3) carbonate of lime 1 ton superphosphate, 3 cwt sulphate of potash, ½ cwt blood, ½ cwt; 4) carbonate of lime 1 ton superphosphate, 3 cwt sulphate of potash ½ cwt; 5) carbonate of lime, 1 ton superphosphate, 3 cwt; 6) powdered clay (Papa rock), 2 tons. The whole area was closed up for hay in each of the three seasons.

From the accompanying Table it will be seen that all areas treated produced more feed than the untreated area. During the whole time, when the whole of the area was grazed with sheep and horses, they showed a preference for plots 3, 4, and 5. These were always eaten more closely, they also showed a much closer sward, and clovers were more prominent. The areas top dressed with lime and papa rock respectively, displayed a greener appearance than the unmanured area and also produced slightly more clovers. The pasture on the unmanured plot remained coarse and with scarcely any clovers. Prior to the test, it may be noted that the field had passed through the following phases ; oat cropping ; grass mixture, including more than the average amount of clover, but unmanured ; and paddock for horses and cows with a few sheep for butcher's meat 1912-16. During this last phase the field was top dressed in 1913 with basic slag bonedust and GEAR grass manure 1 ½ cwt., to 2 cwt., per acre.

Tap dressing results, at Marton 1917-19.

Plot No.	Total Weight for 3 years per acre	Net Increased Return for 3 years over « No. Manure Plot »
	Tons	£ s. d.
1.	11.60	. . . .
2.	14.48	2. 17. 7
3.	19.87	2. 3. 9
4.	18.50	6. 13. 0
5.	16.38	4. 7. 0
6.	13.30	0. 5. 7

FIBRE CROPS

1102 – **Flax Cultivation in North Africa.** — I. DUCELLIER, L., (Professeur á l'Ecole d'Agriculture de Maison-Carréé, Algiers), in the *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, 1920, No. 4, pp. 153-172. Marseilles, 1920. — II. Commandant TRIOL (Agent général de Culture de la Société Tunisienne des Lineries Feuillette), La culture du lin en Tunisie, *Ibid.*, pp. 173-178.

I. — In North Africa only one variety of flax is cultivated ; it more or less resembles the Italian variety, having large seeds, short, thick stems, with a large amount of tow, which is coarser than that produced by the Riga type. The Riga flax is distinguished by its long, slightly branched stems, which yield a better tow ; it is widely cultivated in Russia. Various trials of this flax in Algeria have shown that it might be grown there with profit as it does not degenerate and keeps its good qualities whilst ripening earlier than the other varieties.

The author has made trials at Maison-Carrée with several varieties of flax, such as the Zeeland, Pskoff, white flower (North America), yellow seed, perennial flax (Siberia, Sweden), etc. These varieties did not do as well as the Riga, Italian or Algerian flax.

The author advises the use of line selection for the Riga and Algerian flax in North Africa He thinks that for textile flaxes, a microscopic

examination of the layer of fibres would be useful, as it would then be possible to find the correlated characters (inflorescence, capsules, stems, leaves, etc.) which would greatly help the plant breeder to discover, in the field, those individuals that yield most fibre. Practical industrial examination should be used to confirm the anatomical examination. The author deals with the soil and manuring, the preparation of the soil, the crop rotation (in North Africa, flax follows the Alexandrian clover, beans, mangolds, probably also vetchling and well manured chick-pea ; it has been long known that flax cannot be grown again for 6 or 7 years on some soils, but the reason is not properly understood), the choice of seed, sowing, upkeep of crop, harvesting of stems and grain, retting, yield, and cost of cultivation. He concludes with the following remarks :—

The cultivation of flax will be all the more profitable if more care is taken, as the crop can give very high yields. The attention of the farmer should be drawn chiefly to the choice of the variety and the seed, as well as the preparation of the ground.

The exploitation of flax, in addition, is facilitated as far as possible by the improvement of industrial retting.

The grower who deliwers the beaten stalks to the retting mill, will not have to perform the different operations necessary in preparing tow, as these are lengthy and expensive if done on the farm. The crop, thus freed from retting, presents very similar conditions to cereal crops.

It must remembered that proper flax cultivation will enable the cultivators to guard against fluctuations in market prices.

The importance of this industry is greatly enhanced by the demand for its by-products, such as tow, oil, cake and paper pulp, and should become an important source of revenue to North Africa, where the soil is well suited to the crop.

The chances of success appear all the more certain as there will be unlimited openings for a long time yet in the world's markets.

II. — At the Conference held in July, 1920, in the agricultural centres of Materu, Medjer-el-Bab, Béja, and Souk-el-Kemis, questions relating to commerce, the contract between the producers and the Société des Lineries Feuillette, and the cultivation of the flax (time of sowing, seeding, weeding, harvest, tedding and trussing) were discussed.

1103 - **New Zealand Flax *(Phormium tenax)*.** — *The Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, Vol 3, 169-177, 8 plates. London, 1919.

The possibility of growing New Zealand Flax as a commercial undertaking in the British Isles has for some years been a matter of interest and experiment in Scotland and Ireland. The variety with drooping leaves usually grown in gardens is not the form which gives the best yields of fibre, and attempts have also been made to grow the New Zealand flax in places for which it is not suited and the growth is so slow that as a commercial undertaking there could be no possibility of success.

To overcome the first difficulty a consignment of the best fibre yielding varieties of *Phormium* were sent over from New Zealand in 1914-1915

and 1918 and were put under trial in Ireland, Co. Kerry under conditions most likely to be favourable to their growth. Already evidence goes far to show that the possibility of growing *Phormium tenax* in S. W. Ireland as a commercial undertaking is an established fact. Reports from this trial station state that it is difficult yet to estimate the yield of fibre per acre but it will be over 1 ton per year and possibly 2 tons. Once established the plant yields crops for an indefinite number of years.

Experimental plantings should be made on boggy and poor moorland soil. The growth of th se plants in such situations has proved encouraging. The crop can be harvested at any time of year, and the work can be done in any sort of weather. Provided the crop is properly fenced and strong healthy stock planted and kept free from heavy grass just round each plant for the first year, the growth of a limited area should present no difficulties. Fife-sixths of the plants cultivated are of the variety known as the Powerscourt (*Phormium tenax*). This report by Lord VENTRY is compared with reports from other quarters in Scotland. The general opinion hints that although the *Phormium* will grow in almost any soil, it do s best where there is moisture present and also that home grown seed does better than imported seed. Advice is given in one case to cut the outside leaves of each crown every year to give a more regular fibre both as regards length and strength. Another states that the plant grows luxuriantly in cultivated peat soil, well drained.

At present the main purpose for which this fibre is used is for making binder twine and high grade string and cord.

1104 – **The Mechanical Properties of Philippine Bast-Fibre Ropes** — KING, A. E. (Division of General Inorganic and Physical Chemistry, Bureau of Science, Manila), in *The Philippine Journal of Science*, Vol. XIV. No, 6, pp. 561-655, Pl. 5. Fg. 2. Manila, June, 1919.

There are numerous uncultivated species of plants in the Philippine Islands, chiefly belonging to the families Sterculiaceae, Tiliaceae, Malvaceae, and Moraceae which produce fibres derived from the tough bast found in the inner portion of the bark of the stems and of the branches. At present they have no commercial significance in the Philippines, with perhaps the exception of *Abroma fastuosa*, but are used locally for the manufacture of cordage sufficiently resistant and durable for agricultural and animal husbandry purposes.

Lists have been published of the fibre plants including many yield basts, with botanical descriptions and the distribution of species, but no definite data co..cerning the relative strengths are given. No information has been given as to the approximate size of the cords studied, their weight per unit length, their elongation, and the manner of testing.

The present investigation was primarily undertaken for the purpose of securing quantitative results on the mechanical properties of bast ropes. Thirty-eight coils of rope were secured from material authentically identified in the Bureau of Science in 1917 (32 from bast plant series, and 7 from non-bast species). In addition, ropes from two standard cordage

fibres namely : Abacá (Manila hemp) and Maguey were used for the purpose of comparison.

The species from which the fibres listed were obtained are as follows :

(1) Bast fibres.

STERCULIACEAE : *Abroma fastuosa* — *Commersonia bartramia* (Linn.) — *Helicteres hirsuta* — *Kleinhovia hospita* — *Pterocymbium tinctorium* (Blanco) — *Pterospermum diversifolium* — *Sterculia crassiramea* — *S. foetida* — *S. oblongata* — *S. stipularis.*

MALVACEAE : *Bombycidendron Vidalianum* — *Malachra fasciata* — *Sida acuta* — *Thespesia Lampas* (Cav.) — *Urena lobata.*

TILIACEAE : *Columbia Blancoi* — *Corchorus olitorius* — *Grewia bilamellata* — *G. eriocarpa* — *G. multiflora.*

MORACEAE : *Alleanthus glaber* — *Artocarpus communis* — *Ficus Benjamina* — *F. Forstenii* — *F. pachyphylla* — *F. palawanensis* —

BORAGINACEAE : *Cordia cumingiana* and *C. Myxa.*

GNETACEAE : *Gnetum* sp.

BOMBACEAE : *Bombax Ceiba.*

ULMACEAE : *Trema orientalis.*

ANONACEAE : *Goniothalamus Amuyon.*

(2) Non bast fibres.

GRAMINEAE : *Dendrocalamus Merrillianus.*

MENISPERMACEAE : *Anamirta Cocculus.*

PALMAE : *Cocos nucifera* — (*Corypha elata*).

ZINGIBERACEAE : *Amomum* sp.

(3) Standard cordage fibres.

AMARYLLIDACEAE : *Agave cantala.*

MUSACEAE : *Musa textilis.*

Preparation processes may be classified as (1) plainstripping and (2) " water retting ". The two methods yield very different products. One series of experiments was conducted on test pieces in an open air-dry condition and the other on specimens that had been immersed in fresh tap water for 24 hours. A primitive wooden rope laying apparatus is described and illustrated.

Tables are given showing the tensile strengths per unit area of dry and wet tests, and also of breaking length of the ropes tested (that length which when suspended at one end will cause the specimen to break of its own weight). Ropes made of the strongest and lightest fibre gave the highest breaking length. The elongation of bast fibre ropes is generally less than that of most standard cordage fibres. The minimum and maximum averages for dry and wet specimens are 6 and 16 % and 9 and 25 % respectively.

The final summary Table gives all the species with the averages of tensile strength tests, breaking length, weight per unit length, elongation, girth, diameter, etc. The following have here been selected to indicate the species which gave the most successful results :—

I. *Gnetum* sp. —The Gnetum fibre is the most tenacious and has the highest breaking length 8.450 m., and is exceptionally pliable and compares favourably with two high grades of abacá rope, and a high grade machine laid maguey rope. It heads the list even after wetting for

24 hours, and shows augmented tenacity, 31 % strength. Results show in the other cases that wetting generally causes a slight decrease in tensile strength of most bast ropes. Gnetum is both durable and reliable, and is therefore preferred for making wild hog traps, and for trawl fishing and mounting seines.

II. *Abroma fastuosa*. — This has a high uniform strength which compares favourably with machine made abacá rope, and is only second to *Gnetum* sp. in breaking length, but this fibre is unsuitable for use in the wetted condition. When dry it is much valued.

COMPARISON TABLE.

	Mean breaking length	Average weight per unit length	Average elongation at the instant of rupture	
			Dry	Wet
Gnetum sp	8.450 m.	19.7 gr per m.	10 %	12 %
Abroma fastuosa (crude strips)	5.770 m.	83.7 » » »	12 % gauge length	13 % gauge length
Abroma fastuosa (retted bast)	7.740 m.	20.2 » »	no test	no test

Full details are given with regard to the description of each species by the author, and Tables are made giving records of each individual test.

In connection with the fabrication, it may be mentioned that nearly all the bast fibre ropes are laid with three strands with the exception of one case which had only two. The so-called "diameter" of the test specimens given, was calculated upon the assumption that the girth measurement of the rope is a true circle (1).

Results show that the maximum tensile strength of fibres is obtained when they are tested in their untwisted condition. Experiments by RÉAMUR show that vegetable fibres lose anywhere from 14 to 39 % original strength after being twisted into shape

1105 – ***Desmodium leiocarpum* and *D. tilaefolium* as Fibre Plants.**— See No. 1907 of this *Review*.

PLANTS YIELDING OILS, DYES, TANNINS, ETC.

1106 – **Experiments with Peanuts in Mesopotamia** — *The Journal of the Royal Society of Arts*, Vol. LXVIII, No. 3507, pp. 194, London, Feb. 6, 1920.

An interesting account of a successful experiment carried out at Fellujah, on the R. Euphrates, about 38 miles west of Baghdad, has been furnished by the United States Consul at Baghdad. It should be noted that except for a little sesamum and linseed, practically no oil-seed had previously been grown in Mesopotamia.

One-tenth of an acre was sown in June and the crop lifted in November and although the cultivator was inexperienced, the crop when first lifted, gave 2550 lb. of nuts, which when dried gave 1800 lb., per acre. Peanuts are already in considerable demand, large quantities having been

(1, See *Philippine Journal of Science*. Vol. 13 (1918), pp. 285-339. (*Ed.*)

imported from India. At present the nut is consumed in a parched state or is used for making sweetmeats. Later, when the production exceeds the local demand, the surplus will find a ready export as an oil-seed. The variety grown is a tight-husked variety, with a bright red skin, known as the small Japanese. It has the advantage of being quick growing, requiring comparatively little water, and being easy to dig.

Local merchants are much interested in this entirely new production. Demonstration plots at various centres were to be arranged for this year by the Agricultural Department and it should be possible to establish this crop on a commercial scale in a short time.

1107 - **Oil and Oil Cake from Tobacco Seed.** — PARIS, T., in *Bollettino tecnico del R. Istituto Scientifico sperimentale del tabacco. Roma-Scafati* (Salerno), Year XVII, No. 1, pp. 101-151. Scafati, Jan.-March, 1920.

The tobaccos which are not topped and are used for cigarette making are chiefly the Levantine varieties Xanti-yaka and Herzegovina, and to a lesser extent the Porsucian, Ayassalouc and Samsoun varieties. In Italy they are widely grown in the province of Lecce and they are now being tested in the provinces of Teramo, Chieti, Catania and Trapani.

Each Levantine plant yields, on an average, 2.5 gm., of seed, but others, like the " Brasile leccese " produce about 40 gm. About 140 million plants of Levantine tobacco are grown in Italy at the present time, and yield from 2000 to 2500 quintals of tobacco seed per annum, even when losses are allowed for. The composition of the seed is given in the following table.

	Per cent.
Water	9.17
Crude protein	21.87
Crude fat	37.68
Starch and sugar	0.05
Pentosans	2.90
Cellulose	7.15
Crude ash	3.84

Composition of the ash: —

Sulphuric anhydride	1.97
Phosphoric anhydride	22.12
Sodium oxide	3.48
Potassium oxide	28.05
Calcium oxide	9.54
Magnesium oxide	14.63

The seed can therefore be used as a source of oil.

M. D. D'AMATI, of Cerignola, during experiments made by authority of the Ministry of Finance, obtained 30 % of oil from the seed, using hydraulic presses working at a pressure of 350 atmospheres; the residue still contains 3 to 4 % more which can be extracted by means of solvents.

The oil-cake is the colour of tobacco, hard, compact, and not easily

broken. The following tables give the composition, and coefficient of digestibility of this cake.

Composition.

Water	11.83 %
Crude protein	28.63 »
Crude fat	1.64 »
N–free extract	31.41 »
Cellulose	19.90 »
Crude ash	6.59 »

Coefficients of Digestibility.

Protein 65 %.
Crude fat. 80 %.
N–free extract 75 %.
Cellulose 45 %.

The nutritive ratio is very narrow (1 : 80), but this can be corrected by the addition of bran or other starchy materials, by avoiding the extraction of too much oil.

An annual production from 2500 quintals of seed would yield 800 quintals of oil and 1 600 to 1 700 quintals of oil-cake. The cake does not contain nicotine and can be used as a cattle food ; it is very rich in nitrogen, and would constitute an excellent fertiliser.

The oil is clear yellow in colour, without smell or strange taste ; it is excellent for burning, for making soap, etc. The author considers that it is can be used for human consumption, as it contains no harmful substances. It is semi-drying, absorbing 5.16 % oxygen in 2 days and 6.21 % in 8 days (determined by the Livache method).

1108 – **Production of Henna in Morocco.** — See No. 1115 of this *Review*.

1109 – **Vitality of Beet Seed in the Soil.** — Schribaux in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 33, pp. 799-801. Paris, Nov. 10, 1910.

SUGAR CROPS

In 1920, the anthor harvested beet at Montedour (Eure-et-Loire) from fields which had not grown beets for 3 and 8 years. The explanation was the germination of the hard seed, always capricious, which took place over several years and in various seasons.

The appearance of roots in the different parts of the rotation in a beet farm was thus quite natural. The surprising thing in this particular case was the lateness in germination of a considerable number of seeds ; in certain plots the number was about 1 per cent., on certain parts of the oat stubble as many as 50 per sq. metre (probably at places where the seed-plants has been heaped).

They appeared more frequently on certain patches, either because the soil was more clayey there, or because they preferred the headlands, etc. ; this shows how much the physical condition of the soil distinctly influenced the evolution of hard seeds. These facts are instructive for the producers of beets with rich seeds. In order to avoid mixtures that might harm their selection, they should avoid as much as possible, growing seed beets on the same piece of land, even at very long intervals. To

avoid this, they should try to produce varieties that do not yield hard seeds.

1110 – **Seed Production by Cultivated Beets during the First Year.** — MUNERATI, D., in *L'Italia agricola*. Year 57, No. 7, pp. 200-204 + 4 figs. Piacenza, July 15, 1920.

A critical review of Dr. CASSEL's article on the same subject (1) based on the results of methodical studies carried out by the author since 1910 at the R. Stazione sperimentale di Biecoltura at Rovigo (2).

ANNUAL AND BIENNIAL QUALITIES OF WILD AND CULTIVATED TYPES. — Annual, biennal and perennial types of wild and cultivated beets occur. With the help of continuous selection, cultivated beet has gradually acquired the stable equilibrium of a biennal plant. However, in the wild state there is a *predominance* of types which flower and fructify in the first year, and whose roots retain sufficient reserve for the production of seedbearing cyms during 2 or more successive years.

It is easy to displace this equilibrium, *i. e.*, to obtain types mainly annual and biennial both in wild and cultivated plants by starting from types with opposite characteristics. The equilibrium may be only prevalently (and not absolutely) annual or biennial, for it is not possible to fix the annual or biennial character.

DE VRIES calls these types of plants " unfixable ", for continuous selection fails to eradicate the tendency of the biennials to seed during the first year and vice versa. Under different conditions, the same seed may produce a high proportion of annual plants that are mostly biennial. The author considers that the opinion expressed by Dr. CASSEL and many other authors, viz., that the first-year seeding of the beet constitutes a return to the primitive or wild type, that is, an atavic return, is therefore unjustifiable.

The conflicting results of experimentors who have traced the progeny of annuals derived from biennial parents should probably be attributed to the diverse nature of the subjects primarily used in examining the transmissibility of the tendency to seed during the first year.

By isolating plants in flower and studying each descendant separately a distinctly different behaviour can be observed in the descendants according to their parentage.

As a rule:—

(*a*) Beets which seed early tend more easily to produce annuals (these are nearly always characterised by the absence or small number of leaves at the base of, and along, the cymes, and by small thin roots more or less woody tissue).

(*b*) The tendency to produce annuals is only exceptionally transmitted to any great extent by beets that seed late (leaves are normally present in abundance along the cymes and at their base, the roots do not diverge from the normal weight and their tissues are either slightly or not at all ligneous).

(*c*) Beets which have descended from the so-called " rosettes " or

(1) See *R.*, April, 1920, No. 412. — See also *R.*, Jan., 1919, No. 9. (*Ed.*)
(2) See *R.*, May 1917. No. 4275 R. June 1918. No. 645 (*Ed.*)

" annuelles manquées " type have very little or no tendency to became annuals.

A fact which has not yet been explained, is that in every case and under the same conditions, beets that seed in certain years yield progeny in which the tendency to transmit the character is more pronounced than in the progeny of similar plants which seeded in other years.

IS THE ANNUAL TENDENCY A SIGN OF DEGENERATION DUE TO DEFECTIVE SELECTION ? — Dr. CASSEL replies in the affirmative, but the author remarks that it is very easy to obtain beets that tend to seed in the first year, both from beets rich in sugar, that is, very much selected beets and from very poor types.

THE INFLUENCE OF SOIL AND SEASON ON SEEDING. — All the workers are agreed that plants from the same seed show different tendencies to " rogue " according to the cultural conditions under which they have been placed. Early sowing has a particularly marked influence on premature seeding.

The influence of the soil on early flowering has been recognised by most workers, and some experiments made by the author have cleared up certain doubtful points on this subject.

(1) In 1916, comparative sowings made on the same day and with the same seed gave very different percentages of early flowering on land manured with different fertilisers; these varied from 1 to 2 % on non-manured sandy soil to more than 50 % in open soil that had been heavily manured.

(2) The remarkable tendency to rogue, of beets in the 2nd or 3rd generation derived from annual parents is shown even though sowing is late, and when not even arrested growth or other causes can provide an explanation.

In 1918, the author obtained more than 90 % of annuals from seeds sown on April 26 (*i. e.*, later than in the Rovigo district), and which showed a tendency to behave like annuals in 1919, although in smaller numbers and despite sowing effected in July.

It is a recognised fact that beets may not seed even in the second year and this is why it is questioned whether seeds from beets that have flowered in the third year may give progeny less liable to rogue in the first year, and some workers have concluded, from their own experimental results that this is so; but Prof. MUNERATI is unable to agree with them on this point, judging from his own observations.

1111 – **Isolation of Sugar Beet for Seeding Purposes.** — VILMORIN, J., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI, pp. 365-369. Paris, April, 14 1910.

The author first explains that in his laboratory at Verrières, the richest or first-class roots are examined one by one in respect of their progeny, the lines so obtained serving as a basis for future selected seed-bearers; then he describes the method used for isolating the roots.

Each beet is surrounded by a galvanised iron sheet half buried in the soil and to which is fixed a cloth impermeable to pollen. The whole

is supported by a strong stake stuck in by the root and carrying wooden hoops to support the cloth. The plant is thus enclosed in a kind of tent with an opening that can be closed if desired ; pollination is assisted by shaking the central stake.

The operation is usually performed on half-roots, the other half being left to flower in the open air. If this other half is considered to be of special value it is isolated by distance (" Raumlich-isoliering " in the German).

In spite of the bad conditions under which the plant grows if experimented with in this way, a sufficient number of seeds is obtained to permit of judging purity of the plants isolated. The author confirms the existence of self-sterile plants, and gives Tables showing the weights of the seeds obtained from them. No cases of degeneration were observed with these isolated plants. The sugar-beet, however, has recessive characters, except as regards the weight of the seeds.

The author confirms this by quoting, as an example of perfect, recessive fixation, certain strains of mangolds with red leaves and green petioles which never produce plants with red leaves and petioles. Therefore it must be admitted that abnormal characters such as red leaves and yellow skin are due to defective isolation.

1112 – **The Effect of Salinity on the Growth and Composition of Sugar Cane Varieties.** — Row, K. K., in *The Agricultural Journal of India*, Vol. XIV, Pt. 4, pp. 486-493. pl. 3, charts 5. Calcutta, 1919.

Soft, thick, juicy varieties of sugar cane do not come up at all in saline land, whilst, thin hard and less juicy varieties come up fairly well. The former may however succeed better under less saline conditions, and this difference is traced to be due chiefly to sodium chloride.

The effect of saline irrigation is to give an impure juice containing large amounts of chlorine and potash and a determination of chlorine alone, which is comparatively easy, will give an idea of the approximate quantity of the potash.

As the usual method of determining chlorine by evaporating the juice, igniting the same, and determining the chlorine in the water extract is not quite feasible in a field laboratory, the author proposes a new method of directly determining chlorine in the juice by lime water and alumina cream ; 50 c.c. of the sugar cane juice is measured out into a 100 c.c. measuring flask, neutralised with pure lime water, 25 c.c. of alumina cream added and the whole then made up to 100 c.c. with distilled water. This is then transferred to a beaker and kept covered on a sand bath for some time till albuminoids etc., in the juice begin to coagulate and settle down. On filtration the filtrate is found to be clear, and ready for titration. For impure juices, a small quantity of bone char may be added to ensure a clear filtrate ; 25 c.c. of this filtrate (equivalent to 12 ½ c.c. of the original juice) are taken and titrated against decinormal silver nitrate solution : though this method gives slightly higher percentages than that obtained by the ignition method, the results give a correct idea of the relative quantity of chlorine in the juice.

The chlorine content of a variety depends upon: *a*) Conditions of soil, water etc. under which it is grown; *b*) the nature of the variety itself. The effect of large quantities of chlorine in any juice is to lower the sucrose purity, and glucose contents of that juice. A high percentage of soluble salts in the juices of canes grown under saline conditions is usually associated with a low glucose content and interferes with the crystallisation of sucrose.

1113 – **Extended Cultivation in Java and Introduction inte Indo-China of Two New Varieties of Sugar Cane.** — See No. 1084 of this *Review*.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

1114 – **Cocoa Production in the British Empire and other Countries.** — *The Bulletin of the Imperial Institute*, Vol. XVII, No. 1, pp. 40-95. London, Jan.-March, 1919.

In this article a comprehensive account is given of the present production of cocoa within the Empire, but an account is also given with regard to production in other countries.

Among the countries of greatest export Trinidad may be taken, with Venezuela, as an old cocoa producing country which has steadily been increasing its output during recent years, and the Gold Coast affords the most striking example of quick development of cocoa cultivation in any country where it is grown. The Table shows the production of raw cocoa in the chief producing countries in the years 1912 to 1917, as far as figures are available.

The relative importance of cocoa growing in some of the chief countries of production is indicated to some extent by the following figures, showing the exports of cocoa in cwt., per square mile:

San Thomé	1 487.9
Grenada	785.7
Trinidad	230.5
San Domingo	21.1
Gold Coast (1)	12.6
Ecuador	6.6
Venezuela	0.8
Brazil	0.2

(1) Colony and Dependencies.

To the first three of these countries Fernando Po should be added as an island where cocoa plantations absorb a preponderating share of the land used for agricultural purposes.

Only three species of *Theobroma* need be recognised as constituting raw cocoa as exported:— namely: *Theobroma Cacao*, *T. pentagona*, and *T. sphaerocarpa*. The first is that in most common use, and has split up in cultivation into some well marked varieties which are grouped as follows: "Forastero", "Criollo", and "Calabacillo".

According to VAN HALL, 1914, "Criollo" cocoa is grown only in Venezuela, Ceylon, Java, Samoa, Madagascar and Nicaragua, and "Forastero" is also found in those countries but alone in Ecuador, San Thomé, Trini-

Production of Raw Cocoa.

Países	1912 Cwt.	1913 Cwt.	1914 Cwt.	1915 Cwt.	1916 Cwt.	1917 Cwt.
Gold Coast	772 933	1 011 071	1 057 764	1 545 560	1 443 236	1 819 280
Trinidad	377 764	429 610	566 499	482 870	479 393	626 294
Grenada	101 043	105 284	103 690	120 402	109 772	—
Jamaica	65 675	46 359	72 299	68 487	64 360	—
St. Lucia	17 094	14 588	14 232	18 478	14 575	11 716
Dominica	11 609	9 560	8 602	10 664	5 514	—
St. Vincent	2 005	1 908	2 010	2 114	1 596	1 191
Montserrat	33	40	24	29	49	—
Total. Brit. W. Indies	**568 223**	**607 349**	**766 356**	**703 044**	**675 259**	—
Nigeria	67 801	72 427	98 777	182 096	179 121	308 841
Ceylon	71 754	68 526	54 633	83 483	73 245	72 697
British Guiana	102	505	445	533	416	71
Uganda	—	—	—	164	258	—
Brit. Honduras	93	445	184	164 (1)	164	—
Fiji	80	70	108	94	21	—
Mauritius	—	19	20	20	—	—
Seychelles	14	15	4	3	—	—
Total. Brit. Empire	**1 481 000**	**1 760 447**	**1 978 291**	**2 515 161**	**2 371 720**	**2 857 500**
Brasil	609 840	595 160	802 236	885 142	860 347	1 094 561
Ecuador	708 374	774 723	829 025	728 461	839 606	800 000
San Thomé	660 571	657 651	655 853	588 271	652 797	607 753
San Domingo	410 069	383 264	408 335	397 960	414 293	478 000
Venezuela	281 245	291 402	352 127	359 724	298 760	394 437
Cameroons	89 580	103 636 (2)	80 000	(3)	(3)	(3)
Fernando Po	43 876	55 588	61 868	76 058	65 909	73 736
Dutch Guiana	19 006	30 077	37 252	33 611	39 632	37 921
Java	46 534	41 390	31 112	28 713	28 949	30 600
Haiti	61 306	34 992	41 837	35 067	39 622	30 364
Cuba	39 368	27 636	36 228	33 060	29 500	29 500
Belgian Congo	16 633	17 000	9 503	12 200	15 152	15 310
Guadeloupe	18 196	17 878	22 126	(3)	(3)	(3)
Samoa	14 400	16 000 (2)	13 000	(3)	(3)	(3)
Martinique	9 860	10 305	8 835	(3)	(3)	(3)
Costa Rica	6 081	7 559	6 496	(3)	(3)	(3)
Other Foreign Countries (4)	(2) 18 400	(2) 19 500	(2) 20 000	(2) 166 000	(2) 176 000	(2) 179 000
World's Total (5)	**4 534 000**	**4 844 000**	**5 394 900**	**5 857 050**	**5 829 000**	**6 628 000**

(1) Figure for 1915. — (2) Estimates. — (3) Included in " other Foreign Countries ". — (4) Columbia, Mexico, Togoland, Gaboon, German New Guinea, Madagascar, French Guiana, German East Africa, Ivory Coast, Dahomey, Réunion and New Caledonia ; and in 1915-17, also Cameroons, Guadeloupe, Samoa, Martinique and Costa Rica. — (5) Approximate figures.

dad, West Indies, Gold Coast, Surinam. etc. The cocoa in Trinidad has, however, been classed by HART (1911) as Trinidad " Criollo ".

T. pentagona is a native of Central America, and is grown on a commercial scale only in Nicaragua, Mexico, and Guatemala. It gives satisfactory stocks for *T. Cacao*.

T. sphaerocarpa is said to be common in cocoa plantations in San Thomé.

Details are given with regard to cocoa production in individual British Colonies and Protectorates, especially the Gold Coast where reference is made to the fact that the natives do not pay sufficient attention to the combating of pests (*Sahlbergella singularis*, *S. theobroma* and a *Helopeltis* sp., etc.) and also to diseases that are so likely to increase to a damaging degree.

Amongst those Possessions which have attained importance in respect to cocoa production, the West Indies and Ceylon appear to offer the best prospects for further extension of plantations under European control, and the Gold Coast and Southern Provinces of Nigeria under native farmers, but the introduction of better cultural and manufacturing methods is first necessary in respect to the native plantations.

A Table gives the quantities of raw cocoa consumed in various countries from 1911-1913, United States, and Germany taking the head of the list. Further Tables give details of the imports and exports connected with the cocoa trade of the United Kingdom, and points of information are given indicating extension prospects in the future.

1115 - **The Aromatic Plants of Morocco.** — I. GATTEFOSSE J., La Coriandre, le carvil, le cumin et leur culture au Maroc, in *La Parfumerie Moderne*, Year XIII, No. 1, pp. 2-5. Lyons, 1920. — II. Le henné au Maroc. *Ibid.*, p. 3. — III. Les plantes à parfums au Maroc, *Ibid.*, p 12 — IV. DE LORGUES, J., Les plantes aromatiques du Maroc. *Ibid.*, pp. 17-21. — V. Statistiques. *Ibid.*, p. 22.

At present, there is no European industry of the distillation of perfume plants in Morocco. The natives, however, use large quantities of scents, which they make with primitive apparatus, employing simple methods. It is certain, however, that the good, irrigable soils, which occur in almost all the pacified regions of Morocco, and especially in the district of Marrakech, would be most suitable for the systematic and intensive cultivation of flowers. The aromatic or scented plants of the country are not limited to the cultivated varieties, and many wild flowers of which but little is known are well worth the attention of those engaged in the perfume industry. The following is a summary of the chief aromatic plants of Morocco, arranged according to their families.

RANUNCULACEAE :— *Nigella sativa* L. is grown on a very limited area in Morocco; in 1915, however, 397 kg., of the seeds of this plant was exported. *Nigella damascena* L., *N. arvensis* L., *N. hispanica* L. var. *intermedia* and *N. sativa* L. grow wild in the country.

CRUCIFERAE :— *Nasturtium officinale* L. (water-cress) is also grown on a very small scale. In 1914, 1568 kg., of seed was exported, but the next year the amount fell to 393 kg. *Cochlearia armoriaca* L. (horse-radish)

is also grown in Morocco, its seeds being exported for use as a condiment, but during the war there has been little demand for them. The export in 1913 was 12 329 kg., but fell to 5973 kg., in 1915. The aromatic root is rised in perfumery.

CAPPARIDACEAE:—*Capparus spinosa* L. (caper) grows wild on the Moroccan coast, especially in the South. Its aromatic buds, or capers, are gathered regularly. Before the war, the export trade was chiefly directed to Germany, but now the chief buyers of capers are the English and French. In 1915, Safi exported 2600 kg., of capers to England and France, as against 3339 kg., to Germany on 1913.

GERANIACEAE:—*Pelargonium Radula* L'Hér. var. *rosodora* (pink geranium) and another commoner kind that is not yet exactly determined, grow plentifully in the gardens of Morocco. *P. radula* var. *rosodora* from Algeria which yields a much prized scent, is largely cultivated throughout east Morocco. The finest crops are now grown at Oujda and the plain of Triffa. The "hamri" and "tirs" soils of the west coast of Morocco seem to suit this geranium equally well. Large areas were planted under it at Casablanca and Marrakech in 1919.

RUTACEAE:—*Citrus* sp. There is a primitive native distilling industry of *Aurantiaceæ* centred at Fez and Marrakech. In the neighbourhood of Fez, over 10 000 Seville orange trees are to be seen, but at Rabat, the sweet orange-tree predominates, whilst the mandarin is the favourite at Marrakech, and sweet and acid lemons trees are plentiful in the South. The weight of fresh flowers yielded by a Seville orange-tree (the average of 89 trees in the Marrakech Experiment Garden) was 6.830 kg., in 1915, and 2.573 kg., in 1916, which shows a marked seasonal variation. The Service des Domaines and that of the *Habous* (property of Religious Communities) possess plantations of *Auranticaceæ*, where the flower crop is sold in the trees by public auction. The natives usually distill these blossoms (the flowers of the lemon-tree, orange, Seville orange, and limes, etc.) mixed together by primitive methods that produce a scent that is much used by them. However, there always remains a certain quantity of orange-flower water for export, chiefly through the ports of the Spanish zone; the amount has been increasing of late years, and has risen from 328 kg., in 1913 to 1187 kg. in 1915. The price of orange-flower water is about 1 franc per litre. Extract of neroli is not made by the Arabs as they are too badly provided with apparatus.

ANACARDIACEAE:— *Pistacia vera* L. (or the pistachio) is a shrub sometimes cultivated. *Pistacia atlantica* Desf. is a larger plant than the true pistachio; it has aromatic fruits, and is widely grown in Morocco and Algeria.

ROSACEAE:— *Rosa* sp., The scent rose of Morocco appears to be a variety of *Rosa moschata* L. Roses are only cultivated on a large scale in Maghzen Morocco, in the neighbourhoud of Marrakech, though they are grown to some extent near Fez and Tetouan. At Marrakech, all the gardens are full of roses. South of the Atlas Mountains, the only roses known are those of Sous and of Taroudant, a town which exports many

dried rose-buds to Marrakech. In the gardens of Marrakech the roses are not planted thickly, but are grown on the borders of plots or in spaces between the trees bordering the walks. In spite of the rare occurrence of spring frosts, the rose-crop is poor, owing to lack of care in cultivation. One bush bears an average of 500 to 700 flowers, weighing, when fresh, from 1 kg., to 1.5 kg. The real centre of the dried-rose industry is the region, still almost unknown, lying between the Upper Atlas in the north, and Djebel Sarro in the south, and perhaps to some extent, the neighbourhood of Tamghrouth and of Tafilalet ; these roses are exported by way of Safi and Mazagan to France and Spain. Much is said of the roses of Tafilalet, but none of the varieties on the market of Marrakech seem to come from that region. The roses most prized in Marrakech are from the oases of Skouras and Daddès where the population is extremely dense. On the Marrakech market, the so-called " Entifa " and " Glaoua " dried roses are also sold ; these appear to be produced in the Atlas Mountains themselves, but according to an official report, they are less in request. Safi and Mazagan exported 25 329 kg., of dried roses in 1913, 8536 kg., in 1914, and 18 541 in 1915. At the present time, these flowers are also exported from Casablanca and Mogador : they go, not only to France and Spain, but also to the United States and Tunisia. The following table shows the distribution of this trade during the war, in 1916 and 1917.

	Casablanca	Mazagan	Safi	Mogador
1916	2 702 kg.	9 767 kg.	12 453 kg.	3 039 kg.
	3 836 fr.	12 001 fr.	22 380 fr.	3 039 fr.
1917	2 015 kg.	3 788 kg.	6 519 kg.	589 kg.
	7 999 fr.	5 588 fr.	8 141 fr.	913 fr.

The flowering season lasts from the beginning of April to the end of May. The women employed in gathering the roses are paid from 0.50 fr., to 0.75 fr. per day, the men being paid from 2.50 fr., to 3 fr. The flowers are sold by the " retal khodari " of 0.864 kg. In 1916, the price varied from 1.40 fr. retail, to 0.80 fr. wholesale. Distillation is carried out on the spot, by a very primitive process ; in Marrakech, about ten small traders distil some 10 000 kg., of fresh roses monthly, obtaining approximately 5000 kg., of rose-water. As a rule, however, the natives of the middle and leisured classes make their womenfolk distill the rose-water they use so largely from the flowers of their own gardens. The great demand for this scent has a considerable influence on the price of fresh roses, but the fact that the scent is sold on the spot would greatly reduce the cost price of rose essence, if it were made commercially.

Marrakech also supplies the coast-dwellers with small quantities of rose-water at prices that vary according to the quality, but usually about 2.20 fr. per litre.

The dried roses (entire floral buds) from Sous and Dràa arrive daily at Marrakech from May until the end of June. The Daddès roses are the most in request, and fetch the highest prices; after them come the Skouras roses. It is estimated that 40 to 80 metric tons of roses, of the value of 200 000 fr., leave Marrakech annually. The transactions are carried out at the Mellah, in the "fondouk" of the druggist's shop, always an important place in Arab countries. Formerly, the "quantar attari" (54 kg.) was worth 8 to 12 fr., but in 1915 the price started at 20 fr. and rose to 35 fr. at the end of the season. In 1916-1917, the high prices kept up and even increased by 25 to 100 fr., between 160 and 175 fr. were paid for 65 kg., during the 1918 season. The principal market for roses is, however, Morocco itself, for only some 30 tons were exported.

It seems that the rose-bushes now found at Marrakech and Taroudant, etc. would yield larger crops with better cultural care and the gradual replacing of plants past bearing. On the other hand, all the regions of Morocco contain soils suited to new plantations, which could be managed by competent natives. Thus it would appear that no practical difficulties stand in the way of extending the cultivation of roses.

LYTHRACEAE: *Lawsonia alba* Lamk. (= *L. inermis* L.) is the plant known as henna; it is chiefly grown in the neighbourhood of desert zones, and is greatly used by the Arabs. Its fragrant flowers could also be employed in making perfumes, and it is one of the most important dye-plants of Morocco. In 1917, according to the Terbib statistics, the henna crop covered 161.35 hectares, which were distributed as follows: —

Regioni	European	Native
	hectares	hectares
Fez	—	0.13
Rabat	—	26.50
Casablanca	2.0	7.23
Doukkala	0.12	135.37
Total	**2.12**	**169.23**

Morocco produces less henna than it consumes, as can be seen from the Customs statistics:

	1913	1914	1915
	kg.	kg.	kg.
Import	48 996	85 392	99 634
Export	900	1 875	925

These figures show the desirablity of increasing the production of henna in Morocco. Systematic cultivation trials of the plant have just been

begun at the Fez Experiment Farm and at the Experiment Station at Marakech.

Henna is chiefly grown at Azemmour, Sidi-Ali, and Mazagan, and on a few plantations in the interior of the Doukkala, but these are of minor importance. Henna is an irrigated crop, and therefore the plantations are situated near wells, or " sanias " (areas that can be irrigated from the same well). The area of a sania under henna varies from a few areas to about 1 hectare. The natives only cultivate this plant on clay or sandy loams ; light, sandy soils do not suit it and when grown on such soils, the yield is lower, and the plantations last but a short time, 5 or 6 years, whereas on shallow, calcareous soils they grow for 10 years on an average. Water containing much salt is very injurious to henna. It is usually grown with a catch-crop. The land-owner provides the " sania " and furnishes the animals required to work the " noria " during the growth period. At Mazagan, the yield is estimated at 600 to 900 kg., per hectare.

The prices vary according to the seasons and the quality, the average price of a quintal of leaves being from 200 to 220 fr. The chief market of the Sidi-Ali region is Souk-el-Tnine of the Chiadma Chtouka. The wholesale buyers afterwards supply the different centres of the coast, going as far as Rabat, and even Tetouan, whither the henna is carried by coasting-vessels.

Umbelliferae : — Different varieties of *Foeniculum* (fennel) are found wild, as well as cultivated in the gardens surrounding the towns ; amongst them are *Foen. piperitum* Sweet *Foen. dulce* Mill, and *Foen. Clarryi*, the last named species having a very characteristic and disagreeable odour. Varieties of *Anethum* (dill-seed), are also grown for use as condiments and give rise, like the fennels, to a certain amount of local trade.

The cultivation of *Carum Carvi* L. (caraway) was practised successfully as early as the twelfth century ; it is localised in the region of Meknès, where in 1917, the harvest reached 15 tons. In the vicinity of Meknès, where the caraway is grown on rich, deep, irrigated soil, the seeds are sown in seed-beds in October. When the seedlings are 20 to 30 cm., high, they are planted out, care being taken to raise each with some soil adhering to its rootlets. The caraway is a plant needing repeated irrigation followed by hoeing. The crop is harvested at the end of June, the stalks being cut with a sickle ; they are left some days on the field to dry, and then collected into a heap on a threshing-floor, where the fruits are threshed out, winnowed by a current of air, and put into a sack. As the fruits fall as soon as they are ripe, the state of the crop has to be most carefully watched. This crop is best sown in lines 30 cm., apart, and should be thinned out, leaving one plant to every 15 or 20 cm., to facilitate tillage operations in general. The price of the fruits (seed) rose considerably in 1917, reaching 100 fr., per quintal on the coast markets as against 65 fr., which was the average price the preceding year. In 1914, 10 kg., of caraway seeds was exported, 100 kg., in 1915, and over 10 tons of the 1919 crop have already been exported. This ancient Arab crop is finding a wider market and exportation and once started, will continue to increase steadily and extend.

Cumin (*Cuminum Cyminum L.*) is a crop of considerable importance in Morocco, both on account of its market value and the area of ground it covers. It has long been grown as the Arabs cultivated cumin in Morocco and Algeria in the thirteenth century. According to the statistics of Terbid, 5391.90 hectares were ander cumin in 1917; of these, 23.22 hectares were in south Chaoiua and the rest were in the Marrakech region, which is the centre of the industry.

In the southern regions of Morocco, cumin is sown broadcast in the spring. It needs a light, warm soil, and is harvested in May and June. When taken to the market, it is passed through a winnowing machine and afterwards cleaned by hand by women, the cumin being freed from 12 to 15 % of impurities before being put in 50 kg., sacks for export. Before the war, it was sent to Marseilles, London, Hamburg, and America, and the average price varied, from 80 to 100 fr. Since 1914 the trade has begun to extend to Egypt, and Tunisia, and the price has risen considerably being 145 fr., per 100 kg., on the markets of the Southern ports, and 110 fr., at Marrakech. Most of the cumin is exported from the port of Sarfi ; it pays dues to the amount of 3.96 fr., per quintal. The export from the ports of the Protectorate alone is as follows :

Year	Kg.
1912	1 260 500
1913	515 189
1914	544 935
1915	1.557 280
1916	1.127 271

Owing to the high market prices the cultivation of cumin is increasing and it is certain that in some districts of South Morocco where suitable soils are not lacking, this plant would yield very paying crops in many places.

Coriander (*Coriandum sativum L*). is grown in Morocco: (1) On a large scale by European cultivators in Chaouia (2) on small scale by small native landowners, who cultivate it chiefly as a matter of tradition. Since it has become an article of export, small scale cultivation is tending to change, the Arabs having become more inclined to specialise and to devote themselves to a single crop. Fields of coriander are met with in the districts of Marrakech, Safi, Mazagan, Fez, and Casablanca. In 1917, there were 2592.42 hectares under coriander in Morocco including 2580.68 hectares in Chaouia. Therefore at present the latter district alone can be regarded as producing coriander. The industry has extended rapidly ; whereas only 707.68 hectares were under coriander in 1915, there were 1019.93 hectares under the plant in 1916.

It is sown in the autumn on clean ground, with a warm exposure ; the soil must be deep and light. When the seedlings come up, they must be weeded out, so as tol eave a space of 15 cm., between each plant. Repeated hoeing is necessary. The plants attain an average height of 30 cm.

Nearly the whole crop (especially in August) is exported from Casablanca. The total exportation for the whole of Morocco was :

Year	Kg.
1912	1 795 621
1913	1 484 388
1914	1 861 133
1915	2 793 517
1916	2 920 290

The export tax on coriander is 4.93 fr., per quintal, and the present price at Casablanca is 115 fr., per 100 kg., which represents a considerable advance on the pre-war prices, which were about 25 fr., per 100 kg. The cultivation of coriander is also increasing in Morocco where the conditions are favourable to the production of good yields.

It is also grown in Tripolitania, Fezzan, and Cyrenaica as well as in Algeria and Tunisia, but it does not do so satisfactorily there as in Chaouia.

Dorema ammoniacum :— This umbelliferous plant exudes a substance known as ammoniacal gum, which is used especially in Asia, for fumigating, making depilatory paste, and in pharmacy (diachylon). From 100 to 800 quintals are exported annually from Casablanca, Mogador, and Safi, at an average price of 60 fr., per quintal.

The use of the various aromatic Umbelliferae of Morocco and Algeria Tunisia would entail considerable study, for in these countries the numerous representatives of the family are widely distributed. From such study, much benefit would accrue to therepeutics, and to the perfume, drug, and food preserves industries.

Compositae :— *Santolina rosmarinifolia* L. seems very plentiful on the high plateaux of East Morocco and the Northern slopes of the Middle Atlas. It is a very important perfume plant.

Artemisia Herb-alba Asso., *A glutinosa* J. Gay, *A. Absinthium* L., *A. Camphorata* L. and *A. odoratissima* Desh. all deserve attention from distillers, for they grow thickly and cover extensive areas.

Oleaceae :— *Jasminum* sp. The sweet jasmine and some other ornamental varieties much prized by the Arabs and Asiatics, are plentiful in all the gardens.

Labiatae : *Lavandula multifida* L. :— This lavender grows most extensively in the interior of the country, but also covers a zone lying along the ocean coast : it forms associations with other varieties such as *L. dentata* L. on the actual coast, *L. pedunculata* L. in S. Spain, and *L. abrotanoides* Cav. in the South (this plant is common in Teneriffe). The chief thick associations of lavender which could be easily exploited are said to be in Haha-Chiadma (in the neighbourhood of Mogador).

Mentha sp. :—Mint is a very common plant in Morocco, where numerous scented varieties are reported to be cultivated or to occur wild. In 1919, large plantations of mint were made. Among the strongly-scented North-African varieties the chief are *M. rotundifolia* L., *M. aquatica* L., *M. Durandoana* Malinv. with an agreeable lemon scent, and

the common *M. Pulegium* L. ; *M. piperita* L. is cultivated in Arab gardens in Algeria.

Thymus sp. :—The different varieties of thyme could certainly be turned to account, as they are most abundant. Enormous associations of this plant are found in the Haka-Chiadma.

Origanum glandulosum Desf. :—This plant covers large areas in the Gharb, and forms the object of a considerable export trade through Tangier and Larache ; the exports were as follows :

Year	Kg.
1912	27 574
1913	11 650
1914	10 144
1915	32 409

The Moors cultivate the true marjoram (*Origanum Majorana* L.), and use the flowers and leaves to scent their tea.

Rosemary is stated to be very plentiful in North Morocco, and to be exploited industrially by large firms. Here, as in Algiers and Tunis, *Rosmarinus officinalis* L. and *R. laxiflorus* De Noé (a variety with white flowers and recumbent staiks) should be met with.

Little is known of the Moroccan sages ; *Salvia Aucheri* Boiss., *S. aegyptiaca* L., *S. phlomoides* Asso, *S. algeriensis* Desf., *S. lanigera* Poiret, *S. maurorum* Ball., *S. bicolor* Desf., *S. argentea* L. have been found or could be found in different parts of Morocco.

IRIDACEAE :—The saffron (*Crocus sativus* L.) is grown in Morocco as a dye-plant, but can also be used to furnish an aromatic essence employed as a condiment.

The following quantities of iris root (*Iris florentina* L.) were shipped from the ports of Mazagan and Safi :—

Year	Kg.
1913	73 672
1914	15 879
1915	21 281

CONIFERAE :—*Juniperus phoenicea* L. (Sabine) is much used in perfumery, and is very common in the Mountains (Uppe and Middle Atlas). In the Haha-Chiadma it forms large stands together with the iron-wood tree and *Thuja*. The yew and fir occur more rarely.

Juniperus oxycedrus L. and *J. communis* L. are very plentiful in the mountainous parts of Morocco, and could be exploited on a large scale.

Thuya articulata Wahl. occurs to a small extent everywhere. The chief stands of *Thuya* are in the valleys of Korifla (Rabat) and Mdakra. The variety furnishing sandarac resin is the only kind that is regularly exploited in the Haha-Chiadma and on the slopes of the Atlas to the south of Mogador ; it is no longer exploited in the Zaers and the North of Chaouia. In the northern zone there are 50 000 to 60 000 hectares of *Thuja*

which are still untonched. It is estimated that there are 100 000 hectares under *Thuya* in the Haha-Chiadmas, and the tree also extends further south on the other side of the Sous.

Before ending this very incomplete list, mention should be made of the following plants (as given by various writers), which are aromatic or have scented flowers, and are much grown in the gardens of Morocco in the regions suitable to them :—Bitter almonds, violets, ixias, narcissi, gladioli, peonies, agapanthi, laurels, tumeric, pepper-plants, carnations, nutmeg trees, cinnamon, and aniseed.

1116 – **Manuring Lavender.** — SCHRIBAUX, *in Comptes rendus de l'Académie d'Agriculture de France*, vol. VI. No. 32, pp. 777-778 (Meeting on November 3, 1920); FONDARD L., *Ibid.*, pp. 778-793. Paris 1920.

The growing importance of the lavender crop in the Lower Alps (1) has led M. FONDARD, Director of the Agricultural Services of that Department, to ascertain the best conditions under which the plant can be cultivated. In 1919-1920, he made a special study of the action of superphosphate and sodium nitrate. The following are the results he obtained the first year at Gréoux (Basses-Alpes) :—

Treatment of plot (1451 bushes planted 1.50 m. apart)	Yield of Flowers kg.	Yield of Flowers Index of production	Yeld in Essential oil kg.	Yeld in Essential oil Index of production
Control plot without fertiliser	87.500	100	0.533	100
28 kg. of superphosphate	94.300	108	0.618	116
12 kg. sodium nitrate	180.700	206	1.200	225
28 kg. superphosphate + 12 kg. sodium nitrate	188.500	215.4	1.280	240

All the fertilisers had increased the yield and the content of essential oil ; but nitrogen, which more than doubled the yield, was clearly more efficacious than phosphoric acid and the complete fertiliser proved superior to the fertilisers used separately. It was remarkable that the quantity and quality of the crop had increased *pari passu*.

The experiments carried out in 1920, at Moustiers (Basses-Alpes) confirmed those of the preceding year. The application of 300 kg., of superphosphate and 150 kg., of nitrate of soda per hectare increased the yield of essential oil by 11.33 kg., per hectare, which represents, at the rate of 250 to 300 fr. per kg., an increase in the return amounting to between 2000 and 3000 fr., per hectare.

It only remained to determine the effect of the fertiliser upon the quality of the essential oil. It is claimed that wild perfume plants produce better essental oils than cultivated ones, and it is well known that in the case of certain plants such as mint, the composition of the essential

(1) Cf. L. FONDARD, *Culture de la lavande*. Antibes, La Petite agricole, 1920, pp. 50. (*Ed.*)

oil is influenced deleteriously from the application of fertilisers. This is, however, not the case with lavender. It was found that plants grown in 1916 in the lavender-fields of Gréoux, on garden soil rich in humus, and well irrigated, produced essential oil containing 48.02° of esters, whereas that yielded by wild lavender gathered from neighbouring plots only contained 34°. Similar results were obtained in the Moustier lavender fields: the essential oil from plants that had received no fertiliser contained 38.22° of esters, while the ester content in the case of bushes that had received superphosphate and sodium nitrate was as much as 43.61°. Therefore, the application of fertilisers improves the quantity and quality of the oil of lavender produced.

It has further been ascertained that plants grown on a field with a southern exposure yield from ⅓ to ¼ more essential oil than those gathered on land facing north. The composition of the essential oil is also influenced in the same maner. The oil contained 44.59° of esters when the field had a southern aspect, as against 41.16° with a northern exposure.

These results prove that lavender requires abundant sunshine and also that it gains when cultivated intensively and produces finer essential oil than when it grow wild.

M. SCHRIBAUX advocates the systematic study of the various factors governing lavender production, and especially those connected with selection. As lavender is propagated by cuttings, it would be easy to obtain, in a short space of time, by means of artificial pollinisation, improved races that would be greatly superior to those now cultivated.

1117 – **Results of Qualitative Tests of the Light Yellow Tobacco Produced in Tripoli.** — SAILER, A., in the *Bollettino tecnico pubblicato dall'Istituto scientifico sperimentale del tabacco*, Year XVII, No. 1, pp. 116-145. Scafati, Jan.-Feb. 1920.

The " R. Istituto sperimentale agrario " of Tripoli has studied the behaviour of several kinds of tobacco in that country.

The types were divided into 2 series; the first, grown in the Savari garden (Tripoli) was composed of 8 types, viz., Giant Herzegovina, Haya Solouc, Porsucian, Xanti Yaka, Samsoun 1st crop, Samsoun 2nd crop, Bright Virginia and Java (Brandjar Ardio); the second series consisted only of Samsoun which is cultivated in the oases by natives authorised by the Monopoly Department.

Each type of the first series was divided into three classes: — (*a*) The first and second classes kept together but divided into leaves from topped and non-topped plots; and (*b*) the rejects without any indication of origin. Altogether there were 25 specimens. The non-topped Herzegovina Giant was divided into big and small.

In the second series, the product was divided into 4 qualities, each topped and non-topped, making 8 samples in all.

In the first series, the leaves being cut uniformly and made into cigarettes of uniform thickness, the following results were obtained: — None of the varieties cultivated retained the original properties (aroma,

strength, combustibility) except Giant Herzegovina, which only loses its aroma when the leaves are excessively developed. Java lost all its organoleptic and intrinsic qualities, but bright Virginia gave a product which should be seriously considered, although it differs from the original type.

All the samples had a " hay " taste and aroma, due to incomplete fermentation in too small masses.

Topping was found to impair the combustibility owing to the accumulation of salts in the leaves.

The second series grown in soil that was well fertilized and irrigated, gave a well developed product with a pleasant aroma, but still quite different from the original characters, i. e. unpleasant, bitter tas e and poor burning qualities. Blends agreable to the native taste were also studied, and the mixtures of the Italian State factories were made use of. These were in 1914, 30 % original Samsoun. and in 1916, 20 % of original Samsoun, also the Samsoun was replaced by that obtained in the Colony. The Samsoun cultivated in gardens slightly diminished the quality of the first grade scaferlati tobaccos, but within possible industrial industrial limits, whereas Samsoun from the oasis killed the burning qualities of the blend and made it unpleasant and bitter.

It was with the idea of blending other tobaccos with the original Samsoun that use was made of certain of the other varieties grown in the colony (garden). that had suitable qualities , Giant Hergegovina and bright Virginia were used. In 1914 bright Virginia 40 % was mixed with an increased amount of Bulgarian (12-15 %) ; a satisfactory result was obtained which is duplicated if Herzegovina takes the place of Virginia, and better result is obtained by making up the above 40 % with 20 % Virginia + 20 % Herzegovina.

The weight of tobacco obtained per hectare was : Samsoun 1150 kg. ; Samsoun (second crop) 1530 kg., Herzegovina, 3340 kg. ; Virginia, 2800 kg. ; Xanti, 900 kg. ; Aya, 1040 kg. ; and Porsucian, 920 kg.

The higher yields of tobacco obtained from native cultivation of Fezzania (3000 kg.) and Trablus (2000 kg. per hectare), show that the attempt to obtain a high unit yield from Samsoun has profoundly altered the characteristics of the original type.

The Agricultural Bureau has also experimented with tobaccos giving a high yield such as Giant Herzegovina and the bright Virginia, and if larger yields can be obtained it is hoped that the natives will be encouraged to cultivate the two types.

The author has added to his paper a table showing the results of the 1915 season.

VARIOUS CROPS

1118 - ***Desmodium tortuosum*** **and** ***D. hirsutum*** **as Cover Crops.** — See No. 1097 of this *Review*.

HORTICULTURE

1119 - **Pine Apple Growing in Cuba.** — Muñoz Ginarte B., in the *Estación experimental agronómica, Santiago de las Vegas, Cuba, Boletín*, No. 45, pp. 43-16 photogr. Havana, Sept 1919.

Importance of the pine-apple crop. — In Cuba the cultivation of pine-apples is stationary whereas the demand for local consumption, export

and the preparation of preserves is increasing continuously. The bulletin under consideration urges the growers to devote more ground to this fruit so that it becomes accessible to people of modest means. At present the fruit is not consumed so widely as was formerly the case.

Pine-apples are cultivated in the British and French colonies in Africa, in Ceylon, Siam, Cochin-China, Japan, Australia, Malaya, Melanesia, Polinesia, South America, Central America and Florida,. The region best suited to the crop is the Antilles.

VARIETIES. — Many varieties are cultivated in Florida and the Antilles. In Florida WEBBER has described 25 varieties, the chief of which are red Spanish, Reine d'Espagne, black Jamaica, Grande Trinidad, Enville City, Abbaka, Cayenne, smooth Cayenne, Puerto Rico, and sugarloaf.

In Cuba there are two definite varieties, viz. " piña morada de Cuba " and " piña blanca " or piña de la tierra, " both having spiny leaves.

The " piña morada " has dark, thin narrow leaves, with thorns thinner than those of the " blanca " variety. It has been grown in Cuba since time immemorial, and is the most cultivated variety there not only because of its superior table qualities but because it is more hardy and travels well. The fruit is cylindrical, somewhat swollen in the centre, violet in colour before ripe and pale red when ripe. The flesh is bitter-sweet and light yellow in colour. There are many buds at the base of the fruit and there is a large regular crown (bud) on the top. In some places the fruit is harvested whilst quite sweet and in others somewhat acid with the result that it has been erronously considered that the fruit belonged to two different varieties. The fruits weigh from 2. 6 to 6.9 lb., and will keep about 3 weeks; they can be made into jam.

The " blanca " variety has larger leaves of a clear green colour and with sharp thorns. The fruit is conical, the base being greater than the length. It remains green until fully ripe, and has a white, jucy, slightly acid flesh.

This is the variety preferred for table use, which accounts for its high price The fruit, however, cannot be exported as it rots and ferments very rapidly. Antiseptics such as sulphur dioxide and alkaline sulphites and also protective envelopes have been used in attempts to preserve the fruit for exportation, but with little success.

In Trinidad an intermediate variety between the " morada " and the " blanca " is cultivated. Varieties have been introduced into Cuba from Florida but have not given satisfactory results.

SOILS. — There are 4 well defined of types of soils in Cuba:—

(1) *Coloured soils* (" *colorati* ") abundant in the provinces of Havana, Matanzas, and certain regions in the north and east of the province of Pinar del Río. The colour is due to the high content of limonite (iron ore); the soil contains 45 to 60% of sand and 20 to 35% of clay, and is of average consistency, well adapted to the cultivation of pine-apples, especially if the sand is present in large grains, which allows of sufficient aeration for the roots. The plants live from 5 to 10 years but would last longer if fertilisers were used.

(2) *Sandy soils* in Pinar del Río and other districts.. They contain from 65 to 90 % of sand (grains of all sizes) and 8 to 20 % of clay. When the sand grains are large, the soil is well suited to the pine-apple which, however, does not do well in the " polvillo " (dusty soils) because they contain up to 55 % of fine sand which clokes the roots. This is why the Cuban savannas (plains) are so sterile.

(3) *Black soils* are found all over the island. The colour is due to richness in organic matter and humus. They contain from 30 to 50 % clay, and are of volcanic, calcareous, or granitic origin ; they are of very a close texture and not suitable for pine-apple cultivation.

(4) *Calcareous soils* are not very widespread in the island, although calcareous rocks are common, the reason being that the rocks contain a large proportion of other elements. These soils are not suitable for the pine-apple, because there is not sufficient aeration and they do not absorb sufficient heat.

Preparation of the ground and methods of planting. — All stones, clods and roots are first removed by repeated ploughing followed by harrowing, and the ridges are made of a height that allows the soil to retain as much moisture as possible. In dry soils, i. e., where the water table is about 2 feet deep, and where the slope assists drainage, wide flat beds are used. Planting may be in simple lines, double lines and in groups of 3, 4, 5 or 6 lines well divided. The first two methods are the most usual.

When planted in single lines the pine-apples are placed at intervals of 1 to 2 ft., on top of the ridge, with 1 to 6 ft., between the lines. This works out at about 14 000 to 15 000 plants per hectare. When double lines are used the plants are in squares 1 to 2 feet apart, 6 to 10 inches from each side of the ridge, the ridges being 3 ft. apart. This method, while utilising the soil better than the other has the same advantages, i. e. the plants grow well and cultivation and harvesting is easy. In plantations where there are 3 to 6 lines per furrow, planting is done in squares 15 inches to 2 ft., apart there being a distance of 5 to 9 in. from the ridges which are nearly 6 ft. apart. The disandvantage of this method is that the centre lines are not so productive as the outside ones.

The plots are 30 to 50 ft., wide, the lines about 17 inches apart and a about 8 ft., wide is left every 195 ft.

Propagation. — The shoots growing in the axils of the leaves of the female plant are used, as well as those growing below the insertion of the fruit and forming the crown. The former shoots bear fruit 1 year after they are planted, and the latter after 18 to 20 months ; plants growing from both are equally productive. The shoots forming on the fruit, and which are also part of the corona, could likewise be used for propagation, were it not that they are always removed with the fruit.

Shoots ready for planting are sold at 4 or 5 *pesos* (20 to 25 fr. at par) per thousand. When planting, care must be taken not to allow any soil to get into the axil of the leaves, or the shoot will die. It takes 8 days for 3 men to plant 1 hectare ; one waters the place where the shoot is to be

planted, another digs the hole and the third puts in the shoot, fills up the hole with earth and stamps it down.

Shoots from the roots or from the axils of the leaves are planted in spring and those from the crown in August and September. The latter type of shoots are the best to use, as the others are liable to be injured in separating them from the parent plant and the work is more costly and slower. Further, they are only found in abundance on old plants that are falling off. Another disadvantage is that the plants growing from root or leaf-axil shoots bear smaller fruits than the crown shoots and those produced by the same plants the next year.

In order to turn to account the vacant spaces in new plantations, bananas, beans etc., can be grown as catch-crops.

It is useless to sow pine-apples, for the seedlings only bear fruit the third year; further, very few of the fruits contain seeds. Prof. CALVINO and the author have, however, used seeds in the work of improving the varieties now cultivated.

Shoots failing to strike, which hardly ever exceed a proportion of 10 %, are replaced 15 to 20 days after they were planted.

CULTURAL OPERATIONS. — These consist in keeping the ground very clean; the plants are usually hoed twice, once when it is necessary to remove the supernumerary shoots (only 2 or 3 are left to replace the parent-plant) and again when the fruits are formed. The suckers that may have grown on the central fruit-bearing axis are cut away at the same time and props are put to the larger pine-apples, which by their weight tend to cause the stem to bend over right down to the ground.

MANURING. — In Cuba, a great mistake is made in not manuring the pine-apple crop, for with a fertiliser, larger fruit can be obtained. On the other hand, as the exporters pay the same price for all pine-apples, no matter what their size may be, there is no encouragement offered to the producer to grow finer fruit.

The author recommends a fertiliser containing 5 % nitrogen 4 % phosphoric acid, and 10 % potash, such as, for instance, a mixture consisting of 41.6 parts of dried blood (10 to 14 % nitrogen) + 8.8 parts of double superphosphate (40 to 45 % phosphoric acid, 20 parts potassium sulphate, 50 % potash) + 29.6 parts of inert material (sand, soil, etc.).

The fertilisers sould be applied as soon as the ridges are made and before planting. A good result is obtained by spreading over the shoot which has just been planted, sufficient dried blood or ground cotton cake ot fill up the interstices between the leaves; in this way, the plant is manured, and the soil prevented from lodging. No fertiliser should be spread before the shoots have taken root, that is to say, about 2 or 3 months after they are planted. The author advises 3 top-dressings with fertiliser; the first, applied 2 to 3 months after planting, should consist of nitrogen 2 kg., phosphoric acid 1 kg., potash 4 kg. (this is enough for 1000 plants); the second, used 6 months after planting, should contain, for 1000 plants, nitrogen 1.5 kg., phosphoric acid 1.5 kg., potash 3 kg., and the third (also for 1000 plants) should be composed of nitrogen 1 kg., phosphoric acid

1.5 kg. and potash 5 kg. and be spread in October or November, 2 month after the plants have flowered. After the flowers-stem has formed, fertilisers are injurious, for they tend to produce malformation of the fruit. It may be noted that in the successive application of fertilisers, the amount of nitrogen is decreased, in order to prevent the fruit becoming soft, and hence keeping and carrying badly ; the amount of potash, which has the contrary effect, is increased. After gathering the crop, the shoots which are to produce new plants are manured with a fertiliser composed (for 1000 plants) of 3 kg., nitrogen, 2 kg., phosphoric acid, and 4 kg., potash.

HARVEST. — The pine-apples are known as 18, 24, 30, 36, 42, or 48, according to the number required to fill a small case called a " huacal, " which is 92 cm. long, 26.5 m., wide and 30 cm., high. It is generally estimated that 90 % of the Cuban variety of pine-apple, known as " Morada, " bear fruits ; of these 60 to 70 % are 24 to the " huacal " or larger, and the remainder are of different sizes. The second year after planting, 85 % of the pine-apples bear fruit, but only 50 % the third year. After the third season, it is advisable to make a new plantation, growing another kind of crop in the pine-apple field. One man with 2 assistants, carrying alternately the fruits (neatly cut a little below their base) in baskets to a little cart, can gather 300 dozen pine-apples in a 10-hours day, which means that such a gang can clear one hectare in 4 days.

The pine-apples, are taken to the packing-rooms, where they are allowed to cool at least for one night and are dried, if they have been cut in wet weather. They are then graded according to size, wrapped in paper, and packed. A good packer can fill 400 cases in one day.

CULTURAL EXPENSES. — The author gives the following figures as being most representative (1 peso equals 5 francs at par) :—

I. — *Expenses and Profits per hectare of pine-apples grown for local consumption.*

EXPENSES.

Ploughing four times	230.00
Ridging	92.50
Purchase of 15 000 shoots at 25 fr. pr 1000	375.00
Planting	200.00
Establishment expenses	**897.50**
Interest at 1 1/2 % per month on 897.50 fr, for 18 months	242.10
Working expenses, hoeing, etc.	550.00
Rent of ground for 18 months	112.50
Interest on this outlay for 18 months : 662.50 fr. at 1 1/2 % per month	178.00
Expenses at end of first year	**1.980.10** fr

RETURNS.

From 15 000 plants, 90 % of which bore fruit, were obtained 13 500 pine-apples selling at 1.50 fr. the dozen	**1 687.50** fr
Deficit	**292.60** fr

EXPENSES.

Cultural operations	305.00 fr
Rent of ground for 1 year	75.00
Interest on 305 fr	30.00
Total expenses	**410.00** fr

RETURNS.

From 15 000 plants, 85 % of which bore fruit, were obtained 12 750 pine-apples fetching 1.50 fr the dozen	**1 593.00** fr
Profits realised after deducting expenses of 2nd year	**1 183.00** fr
Profits realised after deducting first years deficit together with the interest thereon viz., 344.50 fr.	**838.20** fr

From this calculation, it would appear that no profits are realized until after the second year, but certain returns have been omitted, such as the sale of shoots, etc. From this source, according to the books of a cultivator and exporter, a profit of 920 *pesos* per *caballeria* (13.41 hectares) or 344 fr. at par per hectare is realised from the first year.

II. — *Expenses and Profits of an Exporter.*
(per hectare of pine-apples producing 13 5000 fruits).

EXPENSES.

Cost of 1125 dozen pine-apples at 1.50 fr per doz.	1 687.50
Cutting the pine-apples	60.00
Three men with baskets	162.00
Motor transport of 1125 doz. pine-apples	337.50
Making and nailing down 490 cases	171.50
Packing (4 men)	60.00
Transport to steamer, at 0.50 fr. per case	245.00
Supervision expenses	50 00
Total expenses	**2 773.50**

RECEIPTS

490 cases at 7.50 fr.	**3 675.00** fr
Profits	**901.50** fr

In the region of Artemisia, the sale price of a case of pine-apples was: 7.50 fr. in 1917, 12.50 fr. in 1918 and 17.50 fr. in 1919.

DISEASE AND PESTS. — The pine-apple is subject to few diseases or pests, amongst which the following may be mentioned: —

(1) " Espiga larga " (lit. wide head): — The plant produces no central leaves and generally no fruit, or else produces a fruit of inferior quality. This disease is attributed to an insufficient amount of fertiliser, especially phosphatic. As a remedy, it is advised to use organic fertilisers with a nitrogen and phosphorus basis, such as dried blood, tankage, and bone-powder. The plants should also be carefully cultivated.

(2) " Marchitez' or wilting: — The roots assume an abnormal shape, the leaves change in colour from green to red then to yellow and afterwards become dark and wilt. As yet, little is known as to the cause of this disease, but it seems to be due to the bad condition of the soil, and want of proper rotation of crop. If the disease appears, the only course is to root up and burn all infected plants, to spread lime over the land, to leave the soil exposed to the sun for some weeks, and to aerate the soil again. When this has been done, new shoots may be planted to replace those that have been removed.

(3) " Hormiga brava " (*Solenopsis geminata* Fabr.) and its associate " queresa " (*Pseudococcus atri* Risso) make their nest in all parts of the pine-apple field and when they happen to place them under the roots of the plant they cause a great deal of injury The best means of controlling these pests is to water the nests with the following mixture: —

Kerosene or refined paraffin	7.6 litres
Crude carbolic acid	0.5 »
Caustic potash soap	225. grammes
Water	3.8 litres

The soap is dissolved in hot water and the carbolic acid added; the mixture is then poured (stirring all the time), into the vessel containing the paraffin; this concentrated solution must be diluted with 18 volumes of water just before use.

INDUSTRIAL PRODUCTS OBTAINED FROM THE PINE-APPLE PLANT. — The sap of the pine-apple contains 12.43 % of crystallising sugar and 3.21 % of glucose. The peel of the fruit, when macerated in water, yields an astringent juice which fermented with sugar, furnishes " garapiña " or " chicha, " a diuretic beverage that is also said to be a vermifuge. The crushed leaves yield a sap that can be used for bleaching plant fibres (flax, hemp, etc.), and when diluted, forms a lye.

Amòngst the products of the pine-apple he mentions:— *Preserved pine-apples* (plain; in brandy; in pine-apple syrup; jam); *beverages* (pine-apple wine and cider; cream); textile fibres (fibres obtained from the leaves).

1120 – **Commercial Dutch Bulb Culture in the United States.** — GRIFFITHS, D. and JUNEMANN, H. E., in the *United States Department of Agriculture, Bulletin*, No. 797 pp. 1-50, Washington, Nov. 22, 1919.

It has been found that stocks succeed under a great diversity of conditions. Thus far, commercial production of Dutch bulbs has been confined mainly to the Atlantic and Pacific Coasts, but recent successes in interior Eastern United States, and Illinois and Michigan seem to prove sufficiently that there is abundant territory adapted to increased production. Bulb cultivation is associated with sandy soils, but in Washington, better tulips and narcissi were produced on silty rather than lighter sandy soils, and they flower well on almost any soil.

Dutch methods have been employed in the greater part of the work, but it is hinted that variations in practice will be inevitable as an industry in bulb production is developed in this country. All details of methods now employed are given, and list of the varieties suitable for cultivation.

1121 – **The Effect of the Position of the Graft in Trees.** — FLORES, G. N., in *Il Coltivatore*, Year 66, pp. 403-465. Casale Monferrato, June, 1920. FRUIT GROWING

A wild plant, or one growing on its own roots, differs from a grafted plant in having more compact tissues with less water, less sugar and more acid. It is to these differences, as is well known, that the tissues owe their longer life and their vigour and resistance to adverse conditions. According as the graft is made at a greater or lesser height (on the branches, trunk, or root-stock, the amount of sap elaborated and therefore put at the disposal of the scion is greater or less, so that the influence of the stock upon the scion is stronger, or weaker.

When grafting is done on the branches, the abundant supply of materials produced by the stock gives to the scion (on account of their greater acidity) superior resistance to parasites, and further, produce in the most easily-affected parts, such as the stems, variations which may take the form of a larger yield of fruit than that of the plant from which the scion was taken. The fruit is, however, often smaller and less sweet when completely mature, and frequently ripen later.

On the other hand, if the scion is grafted on the trunk the wild stock has less effect upon it. The scion will bear fruit similar to that of the parent tree, or even of better quality, but it will be much less vigorous and resistant, and not so long-lived as in the preceding case.

The biological explanation of these differences has been confirmed, in certain districts, by agricultural practice. In this connection, it will suffice to describe the measures adopted in Sicily for the control of gummosis of citrus trees, a disease that first appeared there about 1865 (the attack being very severe for several years), and also those advocated by M. INZENGA, which were carried out in that island for the control of " male della cagna, " or root rot, of citrus trees. The latter were no longer propagated by cuttings and layering as before, but recourse was had to grafting upon a bitter orange tree growing on its own roots, or even to grafting on the shaddock. Shield or crown grafting was adopted, but the grafts were made as high up the trunk as possible, and the effects were immediate and lasting. In the Province of Messina, especially, another method is usually adopted in order to render the stock stronger and the foliage of the sweet-orange graft more luxuriant : — A shoot is allowed to grow on the stock, which is a bitter-orange ; this shoot like the stock, elaborates a sap with the qualities mentioned above, some of which passes into the trunk supporting it. This sap rises from the branches into the leaves, is distributed among them, carrying with it a large quantity of acids which give vigour to the tree, and also protect it from plant parasites, for the latter grow best in an alkaline sap, or one poor in plant acids.

1122 – **Pollination Experiments with Plums in California.** — Hendrickson, A. H., in *Agricultural Experiment Station, Berkeley, California Bulletin*, No. 310, Berkeley, July 1919.

Pollination experiments were started in 1914 with several varietes of plums under the auspices of the Division of Pomology of the University of California, in order to ascertain :

1) Varieties that are self-sterile ;

2) Varieties that are self-fertile ;

3) Varieties that although not self-sterile, may benefit by cross-pollinaton ;

4) Varieties which furnish the best pollen for the various self-sterile varieties ;

5) The relation of weather conditions to the set of fruit.

The most important conclusions may be summarised as follows :

1) The following varieties of Japanese plums were found to be self-sterile : Combination, Kelsey, Satsuma, Burbank, Wickson, Sultan, and Abundance.

2) Climax, another Japanese variety is apparently self-fertile.

3) In general the early blooming Japanese varieties, such as Combination, Kelsey, and Satsuma are scanty pollen producers and not effective pollenisers, while the later blossoming varieties such as Burbank, Wickson, Climax, Sultan and Abundance produce pollen in abundance.

4) Clyman, Tragedy and probably also Grand Duke, are self-sterile, while Yellow Egg, and Pond according to one year's data, appear self-fertile.

5) All of the 5 European varieties tested seem to be abundant pollen producers and to cross-pollinate effectively.

6) The French and Sugar prunes are self-fertile and therefore need not be interplanted wih other varieties, although, however, their yield may probably be increased, especially in certain years, if interplanting is practised.

7) Imperial and Robe de Sergeant must be considered self-sterile for practical purposes.

8) Sugar, Imperial and French prunes cross-pollinate effectively. Robe de Sergeant was found to cross-pollinate readily with Sugar and French, but no trial was made with Imperial.

9) The presence of bees in the orchard is always an advantage. Even self-fertile varieties are benefited thereby.

10) Climatic factors are probably important in the setting of plums, but investigations are not suffciently advanced as yet to throw any light upon this phase of the problem.

The following is a list of self-fertile and self-sterile plums :

a) *Self-sterile* : Combination, Kelsey, Satsuma, Burbank, Wickson, Sultan, Abundance, Clyman, Tragedy, Yellow Egg, Grand Duke, Imperial, Robe de Sergeant.

b) *Self-fertile* : Climax, French, Sugar.

c) *Doubtful* : Pond.

1123 – **The Pruning of Winter Injured Peach Trees.** – GUNDERSON, A. J., in *University of Illinois Agricultural Experiment Station, Bulletin* No. 818, pp. 388-394, Urbana, Illinois, May, 1919.

Unusually low temperatures of the winter 1917-18 caused serious injury to peach trees in southern Illinois. This included the killing of fruit buds and damage to trunks and branches. Discoloration of the inner wood, varying from light to dark brown was the principal internal symptom, but in most cases new sap wood was observed the following November, and this is therefore not an absolute indication of the inability of trees to recover from winter injury.

Trees planted only one year, and also those in high situations showed less signs of damage than older trees and those in lower localities, or those previously harmed by borers, gummosis or starvation.

Experimental work on the Elberta variety gave evidence that moderate pruning produced the best results from the standpoint of size, shape and openness of the trees, and in the number of vigorous fruit buds formed on strong wood, especially with the older tres. Nitrate of soda applied at the rate of 1 lb., per tree increased the amount and colour of the foliage only on the moderately pruned trees, and not on those pruned severely.

In the case of June-budded or small yearling trees planted recently, the usual cutting back to whips is recommended.

1124 – **The Orange; A Trial of Stocks at Peshawar.** — ROBERTSON BROWN, W. (Agricultural Officer, North Frontier Province), in the *Agricultural Research Institute, Pusa, Bulletin* No. 93, pp. 1-7, Pl. XII, Calcutta, 1920.

Investigations carried out in many gardens and nurseries throughout India, in the years 1905-11, led the writer to believe that failure has been caused by mistakes in the preparation of plants in the nurseries and unsuitability of stocks used.

Accordingly, when orchards at the Peshawar Agricultural Station were being laid out in 1911, the opportunity was taken to include a test of the orange stocks commonly used for the Malta and the Sangtara, in North-West India. Fifty plants were grafted on each of the following: *Citrus Limonum*, Osbeck var. (" rough lemon ", " khatti " or " kharna ") ; *Aurantium*, Linn. (" sour " orange, " khatta ", " narang ", " Seville orange ") ; *C. Limonum*, var. (" sweet like ", " sharbete " or " mitha ") ; *C. Medica*, Linn. (" galgal "). An analysis of two samples of soils from the Malta (*C. chinensis*) grove, and two samples from the Sangtara (*C. nobilis* Lour.) grove, were made by the Imperial Agricultural Chemist at Pusa, and show a notable deficiency in available phosphoric acid.

SUMMARY OF CONCLUSIONS. I. *The Malta.* — Of all the stocks used, *C. Limonum* Osbeck var. is the one which gives greatest vigour and fruitfulness.

The *C. Limonum* var. " sweet lime " is suitable in a small private garden only where a dwarf tree with a few oranges of high quality are desired. The stock is unsuitable for commercial groves. The other stocks are not recommended.

II. *The Sangtara.* — In almost all respects, the sweet lime, *C. Limonum* var. is the best stock. The rest are not suitable.

The stock and scion influence each other profoundly in producing vigour and fruitfulness in the orange tree, and in fruit development generally.

The writer states that tests of stocks should be made wherever the orange is grown in India.

VINE GROWING

1125 – **A Test of Commercial Fertilisers for Grapes.** — GLADWIN, F. E., in the *New York Agricultural Experiment Station, Bulletin* No. 458, pp. 27-43, tables 6. Geneva, N. Y. Jan. 1919.

Grape fertiliser experiments were carried out at the above Station from 1919-1918, the commercial fertilisers in use being :— nitrate of soda — dried blood — cottonseed meal — acid phosphate — sulphate of potash, and lime. These were applied annually in varying proportions to different plants.

The tests show that nitrogen, phosphorus and potassium had a marked beneficial effect upon wood growth, yield and quality of fruit.

The first of these three elements was the most helpful both in wood growth and in the increase of fruit with larger berries and clusters. The foliage also after the first few years showed a better colour and size.

Phosphorus and potassium ranked second and the check plat a poor third in this last respect. The two former increased the production of wood and fruit but did not influence the quality of fruit to the same extent as nitrogen. Potassium caused earlier ripening of the foliage than the other elements and gave more pronounced results than phosphorus, but the latter had a more beneficial effect on green manure crops in the vineyard. It affected distinctly as compared with other materials, the growth of rye, barley, wheat and cow-horn turnips, and it is believed that through the promotion of better growth of green manures, it will contribute in a measurable degree to the production of fruit and wood.

Even though the same number of vine canes were tied up for fruiting purposes, the data show that the fertiliser plats produced a decided gain over the unfertilised.

1126 – **Summer Cutting of Hail-stricken Vines.** — SANCINO, F. A., in the *Rivista di Ampelografia* Year I, No. 12, pp. 182. Alba-Livorno, July 15, 1920.

The author has been induced to write this brief article on account of the heavy hailstorms which swept the departments of Alba and Mondovì during the last days of May 1920.

The hail destroyed the leaves and damaged the shoots of the vine, but after 10-20 days, the remaining buds began to show new life and in a short time the vine was covered with many thin shoots which kept it alive but bore no fruit and were of little use for the next dry pruning so that no fruit was produced in the next year.

The loss of fruit over two years can be brought down to one year by suppressing the fructifying shoots and pruning to 2 buds the green spurs, or better still by cutting at the main junction where the fruit shoots

grow out, leaving 2 to 4. As the end of the season there will be a few long thick shoots that can be pruned as usual and next year will produce a normal yield.

The pruning of the shoots of hail-stricken vines is best done in May and June, with slender vines but it can be left to July. If, however, it is done later, at the end of July or in August, the results will not be as good since the new shoots have not had time to develop wood.

1127 – **Direct Bearers Recommended for Venetia.** — Marconi, P., in *L'Agricoltura vicentina*, Year LII, No. 7 pp. 97-101. Vicenza, June 15, 1920.

The author calculates that 18 000 to 20 000 quintals of copper sulphate and 20 000 to 22 000 quintals of sulphur, costing about 8 300 000 *lire* are used annually in Vicenza to combat mildew and oidium on vines.

Phylloxera spreads in this province with great rapidity and it is necessary to replace the present varieties by those able to withstand the attacks of the phylloxera and fungus diseases. After 10 years experience the author recommends direct-bearing hybrids such as Seibel No 1, Seibel No. 2044, Seibel No. 1000, Seibel No. 2000, Seibel No. 60, Couderc No. 7110, Couderc No. 4401. These have proved resistant to fungoid disease, give good yields and are well adapted to the conditions prevailing in this province. All these hybrids are better than Clinton, which formerly was extensively grown in the province of Vicenza and did great service there, but they should now be replaced by the afore-mentioned hybrids, which are more resistant and whose grapes are free from the "foxy." The author also advises that a certain amount of the local "Durella" variety should be grown, as its wine, rich in acid mixes well with that of direct hybrids which have plenty colour and alcohol, but lack acidity.

It is best to cultivate the ungrafted hybrids or to graft them on unharmed vines which have a certain amount of resistance, such as Riparia Gloire de Montpellier, Rupestris du Lot, Berlandieri, Riparia × Rupestris 3309 or Riparia × Berlandieri 420A.

The author concludes by citing the case of an ungrafted hybrid vine which has lived for 6 years in good condition in an area infested with Phylloxera, and of a good direct-bearing vine which has been growing for 10 years at Montorso.

FORESTRY

1128 – **World Rationing of Timber. Need for International Cooperation.** — Unwin, A. H. (late Senior Conservator of Forests, Nigeria), in *The Times Trade Supplement*, vol. VI, No. 92, p. 93. London, 1920.

In 1900 a warning note was struck at the first World's Foresters' Congress in Paris with regard to an impeding famine of timber throughout the world. All timber comes from two sources: (*a*) Forests or trees which have grown up untended or unplanted by man; (*b*) Trees or forests which have been planted, sown, or tended by the present or previous two generations of man. Up to the present time most timber has been obtained from the former type of forest, and only the smallest quantities from the latter.

In the original or virgin forests, timber is cut from trees which have been growing at least 500 years. In so far as such forests are not replanted or trees do not grow again in that locality, man has used the "capital growing stand" of the forests, which cannot be replaced under a minimum period of 40 or 100 years. In so far as the land on which the virgin forest stood is utilized for agriculture, it is lost for the production of timber. Thus, all through the world each year there has been an increasing diminution of the world's potential forests areas. In so far as land is reclaimed and replanted (a little annually in France, Belgium, Germany, in prewar days), there is an increase in the world's timber areas. However, it was a very small amount compared with that taken for agricultural use. Generally speaking, we are gradually using up the world's accumulated growth of trees and forests of many years; in other words, we are not planting, nor is enough forest growing again to replace that which is annually cut down; we are thus living on the world's "wood capital."

Europe's Position. — In Europe, Great Britain, France including Corsica, Portugal, Spain, Belgium, Holland, Denmark including Iceland, Spitsbergen, Germany, Switzerland, Italy including Sardinia, Greece, and Turkey, are large and increasingly timber-importing countries. The chief timber exporting countries are Norway, Sweden, Serbia including Montenegro, Dalmatia, Croatia and Slavonia, Austria, Hungary, Finland, Poland and Russia. Of these it is doubtful how long Austria and Hungary will be able to export timber. Serbia will largely require her own timber resources for her internal development. Poland, once she is organized again, will scarcely have much for export. Thus Russia, Finland, and Sweden are the countries from which greater exports of chiefly softwood timber may be expected. As the most accessible forests have been utilized already, any fresh supplies of timber will be obtained at greater cost than heretofore.

Even including Russian supplies, Europe was not self-supporting before the war, and obtained a large quantity of timber from Canada and the United States. In several countries, such as Great Britain, France, and Belgium, preparations are being made to replant devastated areas and reclaim fresh land by planting trees. However, the produce of these plantations will not be ready for the market for at least fifty years. The areas involved too are comparatively small, a few millions of acres compared with the hundreds of millions of acres from which supplies have thus far been drawn. Summarizing the European position, even with great economy (as enforced by the war) the Continent is not self-supporting, and even with the most complete development of the Russian and Swedish resources, it is doubtful whether it would have sufficient for all its requirements.

The Asiatic Countries. — In Asia we have: (*a*) Timber importing countries, Asia Minor, Arabia, Palestine, Mesopotamia, and China; and (*b*) Self-supporting countries, Afghanistan, Persia, and Java. Of these, Persia will soon be an importing country, once the trade of the country develops. The remaining forests have yet to be properly conserved

and utilised to their fullest extent. With a further increase of the population of Java, the demands for timber will increase, so that eventually she will become a timber importing country. Any industrial developments in any of these countries will cause further demands for timber. Against this contingency we can place (*c*) Timber exporting countries, India including Burma, Ceylon, Siam, Indo-China, the Malay Peninsula, Sumatra, the Celebes, Borneo, the Philippine Islands, Formosa, Japan, and Siberia. India and Ceylon export chiefly furniture woods and teak. It is doubtful whether inthe future, with the development of internal trade, there will be any exportable surplus of softwood timber. Borneo, the Celebes, and Philippine Islands export timber chiefly to China. In the Philippine Islands there are 38 000 000 acres of virgin and secondary forests capable of being used. This is one of the few of the remaining forest resources of the Far Eastern world. Japan, with further industrial development will probably cease to be a timber exporting country.

Australia. — Turning to the Continent of Australia, it is doubtful if Australia can become self-supporting for many years. Probably if the forest of the Northern Territory were exploited, that province would become an exporting country. Papua is a potential source of a great deal of forest wealth, at present largely untouched. It is estimated that there are 90 000 000 acres of forest.

Africa. — On the Continent of Africa there are as timber exporting countries at present, Madagascar, the Ivory Coast, the Gold Coast, Nigeria, the Cameroons, Spanish Guinea, French Congo, Belgian Congo In the last five named countries is the greater part of that vast forest belt which stretches nearly across Central Africa. This will provide one of the few world's reserves of timber in the future. In the Congo alone out of an area of nearly 900 000 square miles, one-half is covered with a heavy tropical forest full of most valuable trees. Cheap form of transport and labour on the River Congo are necessary to make this available for export to other parts of Africa and Europe. Estimating a yield of only 500 cubic feet per acre, and taking the area at 400 000 square miles, or 256 000 000 acres, a total stock is reached of 128 000 000 000 cubic feet of timber. Much of this amount is, at present, quite inaccessible as far as the world's chief markets are concerned. Smaller quantities are available in the British West African Colonies, as well as in the French Congo.

North and South America. — Turning to North America, there are as self-supporting countries, Mexico, Alaska, some of the West Indian Islands. Sooner or later most of these countries will become timber importing countries with the further development of mining and other subsidiary industries. The United States can be considered as only a self-supporting country. At the present time, although a great deal of timber is exported from the southern States and those of the north-east, the country imports ever increasing amounts of timber, and especially pulpwood from Canada. Forest conservation is being rapidly carried out so that from the 200 000 000 acres of forest reserved up to now only the annual increment will be cut. Even allowing for far more forest reserves and plantations,

the amounts of timber to be obtained from all these sources will be insufficient to supply the present requirements of the export trade, as well as the increasing demands of a growing population.

Timber exporting countries are Canada, Newfoundland, Guatemala, British Honduras, the Republic of Honduras, Nicaragua, Costa Rica, Salvador, Panama, Cuba and San Domingo. The Central American States export chiefly mahogany, cedar, and hardwoods, so that they are not so important in the world's economy of timber as the softwood bearing areas of the temperate zones. It should be noted that 85 per cent of all timber at present used is obtained from coniferous forests of these zones. Canada, and especially the province of British Columbia, is America's largest forest reserve of timber. It is estimated that there are 160 000 000 acres of merchantable timber lands in British Columbia : these would yield permanently 6 400 000 000 cubic feet of timber. Already supplying, to some extent the markets of Australia, China and Japan, British Columbia will soon be called upon to export increasing amounts to the United States of America.

In South America timber importing countries are Peru, Uruguay Argentine, and the Falkland Islands. If all the forests of Argentine were exploited she might become an exporting country. At the present time, although she exports large quantities of quebracho wood and extract, she needs large quantities of soft woods. Peru might also become an exporting country if her more distant forests of the Amazon region were exploited.

Self-supporting countries are Chile, Paraguay, and Bolivia. Chile exports a certain amount of timber, but also imports a good deal. Probably, if all her forests were exploited she would become an exporting coountry. Owing to Bolivia's unfavourable geographical position she cannot at present export timber, the distance to the seaboard being too great.

As timber exporting countries there are Colombia, Ecuador, Venezuela, British, Dutch and French Guianas, and Brazil. Up to the present, it has been mainly mahogany, cedar rosewood, and other hardwoods which have been exported.

Brazil's Untouched Forests. — However, there are many hundred of species of soft-wooded trees in these tropical forests which are, at present, scarcely known or used. With the increasing world's demands for timber these will have to be utilized ; in fact, in Brazil the world possesses one of the largest remaining timber reserves ; there is probably at least an area of 640 000 000 acres of untouched forests, which contain at least 320 000 000 000 cubic feet of timber of various kinds. Many of these forests are, however, situated, on the banks of rivers 3 000 miles away from the ocean (1).

The World's Timber Position. — Summarizing the world's timber position, there are two big reserves, in Central Africa and South America, a smaller reserve in Canada, and still smaller reserves in the Asiatic islands

(1) See *R.*, July-Aug. 1920, No. 773. (*Ed.*)

of the Philippines, Borneo, and Papua. During the war the Allies all co-operated in their timber supplies, giving to each other what each required. The previous survey has shown that the world's requirements of timber can only adequately and economically be met by world rationing, and it is to the renewal of this co-operation that must be looked in order to find a starting point for the trading arrangements of peace.

1129 – **The Influence of Suckers on the Production and Form of Oaks in the Preserves.** — MER, E., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VI, No. 24, pp. 595-596. Paris, June 23 and 30, 1920.

The presence of suckers is harmful not only because it results in a feeble and perhaps withered crown but also because they decrease production and change the form of the tree to the great depreciation of its value. The conical form tends to increase and so shorten the rotation period. The quality of the wood is affected by the disappearance of the suckers as the presence of numerous dead knots cannot but depreciate the value of the wood.

It is therefore desirable to prune the saplings as soon and as often as possible after clearing. Long rotation periods help the suckers to persist because of the growth of shoots, and more time being given for them to disappear. Long rotations, however, increase the production and value of the coppices, besides favouring growth in length. On the other hand, the saplings disappear, as they cannot support a long covering, so that in any forest, selecting and marking becomes more and more difficult when the rotation period is 30 years or more.

This can be remeded, still keeping to fairly long rotations by freeing the saplings, sooner, more frequently and more drastically. In order to succeed in this the saplings must be completely isolated so that there is no chance of their being overcome by adjacent shoots. Done in this way the isolation also has the advantage of notably increasing their growth.

If annular decortication (taking care to preserve the sap wood) be also practised, the production of useful wood will be greatly increased and this aim should be sought after more than ever and by every available means.

LIVE STOCK AND BREEDING

1130 – ***Baccharis pteronioides* as a Poisonous Plant of the Southwest, United States.** — DWIGHT MARSH, C., CLAWSON, A. B. and EGGLESTON, W. W. in the *Journal of the American Veterinary Medical Association*, Vol. LVII, N. S., Vol. 10, No. 4, pp. 430-434, figs. 2. Washington, D. C., July, 1920. HYGIENE

Various reports have been sent to the Bureau of Animal Industry of losses of livestock apparently due to a poisonous plant in the forage. In 1918, *B. pteronioides* D. C. (*B. ramulosa* [D. C.] Gray), was found abundant in the Lincoln National Forest, New Mexico by EGGLESTON and where also, autumn and winter losses had occurred. This evidence led to some experimental feedings at the Salina Experiment Station to determine definitely whether or not the plant was poisonous. Consideration was taken into account of the fact that several members of the genus grow-

ing in Mexico and S. America have been used in medecine, and that, *B. coridifolia* is a well know cattle poisoning plant in Argentina, and also infects horses and sheep.

It was definitely demonstrated that the lethal dose for sheep is nearly 1 lb., and although not an actually toxic plant, it is of a decidedly dangerous character. The symptoms exhibited in this case were not distinctly characteristic.

The death of cattle in Southern Arizona and New Mexico can very probably be also attributed to this same trouble. A report received in 1915 describes the following indicative symptoms in cattle: — stiff and jerky action generally, and liability to fits When opened, the intestines were as if they had been burned with potash. In this particular case, the sample of weed which was considered undoubtedly the cause of this effect was identified as the plant under discussion.

The known range of altitude is from 4 000 to 7 600 feet, but is more commonly found between 5 000 and 6000 feet, and occurs from Central Mexico, through the Rocky Mountains of Western Texas, North to Central New Mexico and Eastern Central Arizona.

1131 - ***Triglochin maritima*. A New Stock-Poisoning Plant.** — Fleming, C. E., Peterson, N. F., Miller N. R., Wright, L. H., and Loucк, R. C., in *Agricultural Experiment Station, University of Nevada, Bulletin* No. 98, pp. 6-22. Carson City, Nevada, 1920.

In the autumn of 1918 the authors were informed that cattle had died in Southern Utah from eating a plant known in that region as " goose-grass ". This plant was identified as *Triglochin maritima*, generally recognised as poisonous. It does not seem to be distasteful to animals, which instead sometimes eat it greedily. This fact led the authors to study the toxic capacity of the plant.

An analysis was made of an air-dried sample of the plant, and there was found 0.264 % hydrocyanic acid. Calculated to the original green weight of the plant, this is equivalent to 0.054 %. Poisonous plants of this type appear to have an erratic action both in feeding experiments and also when animals are grazing at will. Apparently the grazing of sheep and cattle upon such plants has not been accompanied with fatal results in every case. Amongst the possible factors which contribute to the action of these compounds should be noted the physical condition of the animal when fed, the state of its health, and whether the food in question is taken upon a partially filled or empty stomach.

Feedings made with *T. maritima* cut at different seasons indicated that the plant is toxic during the entire period of its growth. As regards the affected parts, the leaves have conclusively proved to be poisonous, but it has not yet been found whether the flowers are poisonous which, however, only make up a minor part of the total weight of the plant. The roots are so firmly held down by their fibrous growth that there is little or no chance of their being eaten.

In the autumn of 1918 and in the spring and summer of 1919, 20 animals were fed with fresh green leaves of *T. maritima* ; 7 sheep were poisoned,

5 of which died. The weight of green material required to provoke sickness varied from 1 ½ lb., to 4 ½ lb., the average fatal dose being approximately 2.4 lb. The irregular and apparently inconsistent action of plants containing hydrocyanic acid would render it difficult to state accurately just how much of the plant is required to encourage sickness.

A further series of feeding tests with cattle were made in spring, summer and autumn with varying quantities of green goose grass. The results were negative. One of the animals ate an average of 15 ¼ lb. daily for 7 days with no bad effects. These results, however, should not be taken to infer that the plant is not poisonous to cattle.

Further feeding tests were made with sheep and cattle to determine the toxic effect of various proportions of dry goose grass when put up in in hay and fed. Out of 13 sheep fed, 6 were fatal cases. The smallest amount which proved fatal to sheep was 2 ¼ oz., the average fatal dose being approximately 4.64 oz. These tests prove conclusively that small amounts of the dried plant are extremely poisonons. As regards cattle, one feeding test was made with a yearling calf; the result was fatal, in spite of the fact that only 7 oz., of *T. maritima* hay was fed

Another series of feedings was practised in order to determine whether small amounts of air-dried *Triglochin*, would be harmful when fed in small quantities and at varying intervals. One only of the animals was affected, which showed symptoms of poisoning after the fourth 1 oz., dose. Results indicated that there is little or no cumulative effect of small doses fed at short intervals.

The authors have also made a study of typical cases of animal poisoning and have made anatomical and pathological observations. The first symptom of sheep poisoning was abnormal breathing, usually very rapid, often as quickly as 150 per minute. In other cases it was, however, slow and deep. Abnormal breathing was often accompanied by trembling or jerking movements of the muscles which in severe cases would develop into spasms or convulsions. Fifty per cent. of the autopsy cases showed endocardial or epicardial hemorrhages, and 40 % a spleen that was dark and mushy. In general, the blood was darker than normal and formed a clot that was somewhat soft.

No experiments were carried out to determine whether it would be possible to cure the animals, but there is little hope in this respect, because, amongst other reasons the interval between the time when the first symptoms appear and the fatal results is too short to permit treatment.

On the contrary, a great deal can be done to prevent poisoning: — wet meadows where the goose grass is common should not be cut for hay; the largest clumps should not be cut, or if cut, should be burnt when dry; animals should not be put on pastures containing much goose grass when they are very hungry.

1132 – **The Chemical Examination of Three Species of Larkspurs.** — BEATH O. A., in *University of Wyoming Agricultural Experiment Station, Bulletin* No. 120, pp. 55-88, Pl. XI. Laramie, Wyoming, June, 1919.

The subject matter is confined to general methods employed in larkspur investigation supplemented by such data as seemed advisable to give an intelligent understanding of the facts.

The three species under consideration were *Delphinium glaucescens* Rybd, *D. Barbeyi* Huth., and *D. Geyeri* Greene which clearly represent distinctive altitudes and habitats. The distribution and poisonous effects combined with characteristic symptoms with cattle affected (1) are indicated. This is followed by preliminary tests for the determination of crude alkaloids by the volumetric method. Reference is made to the comparative toxicity of each poison, and in the case of *D. Geyeri* and *D. Barbeyi.* the amorphous product was in each case far the most poisonous, Chemically, the amorphous compounds were found to be quite stable substances. Oxidising reagents such as hydrogen peroxide, nitric acid and potassium permanganate had more destructive effect than the chemicals usually employed in plant analysis.

Remedial measures. — The most advisable recourse according to the Bureau of Animal Industry U. S. A. is the injection directly into the blood by means of an all-metal hypodermic syringe of the following remedy : — physostigmin salicylate 1 grain — pilocarpin hydrochlorid 2 grs. — strychnin sulphate ½ gr. This formula would apply to an animal weighing 500 to 600 lb. The " Quitman » syringe has so far been found the most useful. The needle is most conveniently inserted in the shoulder.

There seems little doubt that prompt treatment of animals poisoned by larkspur would result in the saving of most of the cases.

1133 – **The Weir Vine (*Ipomaea calabra*) and Reputed Poisonous Properties.** — WHITE, C. T. (Government Botanist), in the *Queensland Agricultural Journal*, Vol. XIII, Pt. 6, pp. 269-272, pl. 2. Brisbane, June, 1920.

This plant is fairly common on the hard red soil of the Maronoa District, and reports indicate that the tubers were used as food by the aborigines. According however to the information suppled by GUNN, the author states that when sheep ate the vine they developed symptoms of indigo affected animals. This account was corroborated by other practical stockmen. When the plant first comes up the stock can eat and fatten on it, but it is apparently the pod which does the harm. Horses and cattle were also attacked and the eyes dimmed. When the loins were affected, the results were disastrous.

The yam can be used as a potato and is quite a harmless substitute in this respect.

The leaves of some examples of *Ipomaea batatas* have been found to develop at times hydrocyanic acid yielding glucosides, but the symptoms of this form of poisoning are not identical to those ascribed to *I. calabra.*

(1) See *R.*, Jan. 1917, No. 54. (*Ed.*)

The latter are similar to those generally associated with species of *Swainsona* in Australia and *Astragalus* in the United States, and other leguminous genera, but has not, according to the author, been recorded for any species of *Ipomaea* or other genus of the family Convolvulaceae.

1134 – **Poisoning of Cattle by Feeding on Ergotised Paspalum.** — MITCHELL, D. T. (Veterinary Research Laboratory. Onderstepoort), in the *Journal of the Department of Agriculture South Africa*, Vol. I, No. 5, pp. 422-426. Pretoria, Aug. 1920.

Serious outbreaks were reported from various parts of the Province of Natal In the cases investigated, symptoms had appeared amongst the cattle grazing on paspalum pastures in the seeding stage, and a very large percentage of the heads of the grasses were infected with a fungus of the *Ergot* type This was identified by Dr POLE EVANS as *Claviceps Paspali* which has been noted in other parts of the world to have similar effects (1).

A series of feeding experiments were arranged, and the ergot-infected paspalum was collected from old paspalum lands at the Government Experimental Station at Cedara. The feed consisted of a mixture of seed heads and ripe *sclerotia* , supplemented by bran and chopped lucerne. With 9 to 12 lb., of infected heads, a definite and diagnostic train of symptoms was produced, starting on the second day. This varied in intensity from a slight inco-ordination of movements to complete paralysis and although in the majority of instances the natural cases were comparatively mild, the results produced experimentally were more marked. Recovery was noted to commence about the fifth or sixth day but was not completed until 2 months after the feed was given.

The condition was only observed to occur in cattle, and young stock of from 14 months to 2 years old appeared to be more susceptible than adult cattle. Horses, donkeys, sheep and goats grazed on the infected grass without developing any clinical symptoms.

The treatment found to give most rapid results after the necessary removal from the paspalum lands consisted of a saline purge followed by a few days rationing on green lucerne or barley, the idea being to prevent further ingestion and to assist in elimination of the unabsorbed toxic elements in the digestive tract. Prophylactic measures consisted in reaping and collection of the grass during the flowering season, at which time the material collected from the lands may be fed to cattle with perfect safety. Heavy stocking at the commencement of the summer before the flowering season is therefore advised.

Lowered vitality due to ergot intoxication was considered to be the cause of a number of deaths from " redwater " which occurred amongst a herd of young oxen grazing on the paspalum area previous to their removal to the " red-water veld. "

The toxic symptoms mentioned are exactly similar to those observed by the American investigators, BROWN and RANCK with guinea pigs but

(1) See *R.* 1917, No. 829, 924, 1035 and 1179 ; *R.* February 1918, No. 179. (*Ed.*)

the commercial ergot extract *C. purpurea* was found to produce no distinct ill effects.

1135 – **The Therapeutic Treatment of Sarcoptic Mange in Horses.** — CRIMI, P. in the *Annali della R. Stazione sperimentale per le malattie infettive del Bestiame, Portici*, Vol. V. No. 1, pp. 19-71. Portici, 1919.

The author recommends the following method for treating sarcoptic mange in horses as being efficacious, rapid, and economical. The animal should be shaved and then washed with a soft soap containing 4 % of creolin, and rubbed with an ointment composed of 25 parts (by weight) of flowers of sulphur + 5 parts of tobacco extract (State brand) + 100 parts of vaseline. The ointment should be applied to the animal's flanks, one side being treated one day, and the other the next. Two days after the second application, the animal ought to be washed with ordinary soap and warm water.

1136 – ***Onchocercosis* in Madagascar Cattle.** — CHRETIEN, A. in the *Bulletin économique de Madagascar*, Year XVII, Nos. 1 and 2 (First and Second Half-years, 1920), pp. 47-50. Tananarive, 1920.

Among the rare internal parasites of cattle in Madagascar, there is, in addition to the amphistomata of the rumen and the filaria of the peritoneum, a nematode, which the author, a veterinary surgeon, has found, often in large numbers, in nearly all the adult animals he has examined. so common is this parasite that the author thinks he could almost say, that careful direction and minute investigation would have revealed its pre-Sence in all the cattle submitted to him for inspection. He, however, adds that his researches (made in 1917-1918-1919) were confined to adult cattle from the north of the island which were slaughtered at the rate of 100 to 120 daily to supply the Montagne d'Ambre canning-factory, near Diego-Suarez.

The nematode in question is an *Onchocerca* that was recorded in 1912 by M. PIETTRE, who thinks it is the same as the *Onchocerca bovis* which he discovered, also in 1912, in cattle in France.

The nematodes are located in the conjunctive tissue in the neighbourhood of the ligaments and tendons, but not in them, for they seem unable to penetrate into the tissue of these latter.

No symptoms of the disease are, however, noticeable in the living animal. The author never observed any trace of stiffness of the neck and shoulders, or any difficulty in walking, even when the cattle arrived at the factory, though most of them had just been driven four successive daily stages of 36 to 40 km.

1137 – **Treatment of Retention of the Foetal Envelopes After Birth in Cows.** — PICCIONE, G. in *Il Coltivatore*, Year LXVI, No. 22, pp. 528-552. Casale-Monferrato, August, 10, 1920.

The retention of the foetal envelopes (placenta, membranes) is an accident that frequently occurs after parturition in cows. It is often observed after abortion, whether sporadic, or epizootic, and as a result of

long and difficult calving. The special arrangement of the placental cotyledons in ruminants appears to retard the expulsion of the after-birth.

The author mentions the symptoms of the retention of the after-birth and states that the various drugs usually administered to treat retention have but litte effect. He suggests new methods of treatment :— (1) Friction of the dorso-lumbar region accompanied with the alternate application of hot and cold plasters ; (2) injections of cold water into the umbelical vein of the placenta ; (3) massage of the uterus by way of the rectum ; (4) crushing the yellow bodies. Of these several methods, the first is not certain ; the second ought never to be used, but the third and fourth are efficacious because they induce contraction of the uterus which, after some hours, bring about the expulsion of the after-birth ; they should be followed by uterine douches. The empiric method still employed in the country in Italy which consists in attaching a weight to the portion of the membrane that has already been evacuated is harmful, because the continual pull produces a diphtheric condition of the mucuous membrane of the vagina, or even necrosis, and may perhaps cause inversion or prolapsus ; (5) repeated uterine douches are an easy and efficacious treatment ; (6) the best method, and that most used is the manual extraction of the placenta followed by a douche of hot or luke-warm water, or the introduction into the uterus of 100 to 120 gm., of animal charcoal in the form of 10 gm., capsules, followed 3 days afterwards by a douche (Oppermans' method).

As a rule, farmers do not consider the retenton of the after-birth as a matter of much importance because it rarely endangers the life of the cow, but this is a mistake, because this accident, although slowly, and indirectly, causes losses in stock production that are far from negligible.

The author no longer administers drugs in treating placental retention for they are quite useless ; he has recourse, however, to tonics, and to detachment by hand which, when properly executed, entails no risk but should be followed by repeated douches. To administer the douche all that is needed is an indiarubber tube 1.50 m., to 2 m., long, provided at one end with an indiarubber clyster-pipe to be inserted into the uterus, and at the other, with a funnel to receive the liquid to be injected. A vine irrigation-pump may also by used, provided it is held, so that no air is introduced into the uterus.

The liquids for injection are : 1 % creolin ; iodine water (one spoonful of tincture of iodine to 1 litre of water) ; a 1 % acqueous solution of carbolic acid ; 1 to 2 % permanganate of potassium ; etc. Weak solutions must be used, in order to prevent too violent contraction, which might cause inversion of the uterus. In some very serious cases, the author used tepid well-water which, as it contains no specific germs, is not injurious, even when not sterilised, as Fabretti has shown.

1138 – **Reaction of Milk in Relation to the Presence of Blood Cells and of Specific Bacterial Infections of the Udder.** — BAKER, J. C., and BREED., R. S. (New York Agricultural Experiments Station, Geneva), in *The Journal of Biological Chemistry*, Vol. XLIII, No. 1, pp. 221-235, Bibliography of 18 publications, Baltimore, Md., August, 1920.

In a previous paper (*Journal of Biological Chemistry*, Vol. XL, p. 345, 1919) L. L. VAN SLYKE and J. C. BAKER have shown that decreased acidity of fresh milk is due to the direct filtration of blood serum into the milk as secreted. Because of the importance of this suggestion in explaining bacteriological and physiological problems, the biological data that have a bearing on this theory are discussed in the present paper.

In support of this view it is pointed out: 1) That this view is in harmony with the changes in composition that accompany decreased acidity; 2) that it is in agreement with the hydrogen ion concentration of normal milk (P_H values 6.50 to 6.60) and that shown by blood serum (P_H about 7.60); and 3) that it harmonizes with an increased CO_2 content of the less acid milk, normal milk containing about 10 per cent. by volume of CO_2 and blood serum, 65 per cent.

Further proof of the presence of blood serum was furnished by the presence of fibrin as shown by fibrin stains. This normal constituent of blood does not appear in normal milk.

The only observed chemical relation that was out of harmony with the view that unchanged blood serum caused the low acidity of certain samples of milk was the fact that no glucose could be demonstrated in several samples in which it should have been present in appreciable quantities if this were the case. At that time it was suggested that further investigations were desirable.

From the new data here given, and from histological and physiological considerations, it appears that a more exact statement of the case would be that the infection causes the entrance of a serous exudate derived by the gland cells directly from the lymph rather than from blood. This serous exudate is neither exactly like blood serum nor milk. When the infection has proceeded to the place that actual rupture of the vessels occurs, then unchanged lymph and blood would enter. The modifications in the secretions may be due to a weakening of the secretory activity of the cells or the exudate may have a definite protective function against the bacterial infection, or both conditions may hold simultaneously.

The processes involved are so complicated that it is little wonder that the matter is not clear even with the data at hand. It seems quite probable, however, that the increased CO_2 content of the milk samples having a lowered acidity is correlated with the entrance of bicarbonate from the blood The acidity of the milk would also be lessened by the entrance of increased amounts of basic phosphates or even of albumins. Changes in the secretion of the milk in relation to these substances could easily explain the changes in reaction actually noted without assuming the entrance of excessive amounts of unchanged blood serum or lymph. While these chemical changes are still only partially understood, the data establish

the fact that the modifications of the secretion are correlated with an increased entrance of the leucocytes into the lumina of the alveoli. Accompanying this change in the secretory processes there also seems to be an increasing amount of wastage from the glandular epithelium.

1139 – **Studies on "Debab"** (1). — SERGENT, E. and DONATIEN, A. (Institut Pasteur d'Algérie), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XIII, No. 7, pp. 521-525 and 525-527. Paris, 1920.

I. — EXPERIMENTAL INFECTION OF DROMEDARIES WITH *Trypanosoma berberum* PRODUCING "DEBAB." — This experiment was carried out for 2 years on some twenty dromedaries that were not obliged to work, and were given nourishing food. The animals found to be healthy were inoculated with the blood of naturally infected dromedaries. The results show that experimental infection produces :—

(1) An acute phase of the disease lasting 3 or 4 months with the presence during at least half that time, of trypanosomes in the peripheral blood. The development of the parasites is always accompanied by a rise in temperature.

(2) A chronic phase (lasting months and years), the trypanosomes making their appearance twice a month on an average. This chronic phase passes into a period of latent infection accompanied by a relative immunity to new infection.

The only clinical symptoms characterising trypanosomiasis are :—

(*a*) Loss of flesh and debility, which reduce the dromedary's resistance to pathological influences. Death is usually due to complications.

(*b*) Abortion.

II. — HEREDITY OF INFECTION AND IMMUNITY OF DROMEDARY TRYPANOSOMIASIS. — The authors conclude that female dromedaries transmit the disease to the foetus (which succumbs to it), during the acute stage of the malady only. When in the chronic stage, they transmit neither the disease, nor immunity to it.

1140 – **Biochemical Changes in the Flesh of Beef Animals Receiving Insufficient Nourishment.** — MOULTON, C. R., in *The Journal of Biological Chemistry*, Vol. XLIII, No. 1, pp. 67-78. Baltimore, M. D., Aug. 1920.

ANATOMY AND PHYSIOLOGY

C. W. GREENE (*Journal of Biological Chemistry*, v. XXXIX, pp. 435, 1919) showed that during the period of spawning migration, besides experiencing a loss of muscular tissue, these fish exhibited an impoverishment of the muscular tissue that meant a loss of from 10 to 30 % of the protein content. The organic extractives nevertheless remained fairly constant and even increased under certain conditions.

In a second paper GREENE (*Ibid.*, pp. 457) confirmed the preceding results and showed further that the concentration of amino-nitrogen relative to the water content after an initial increase remained constant throughout the migration. He argued that the results indicate a storage of reserve protein in the salmon muscle.

(1) See *R.*, Dec. 1918, No. 1368 ; June 1919, No. 747. (*Ed.*)

The author in the present case undertook experiments with a view to the determination of: 1) Changes in the protein and other constituents of the flesh; 2) changes in the composition of the liver and blood; 3) changes in the size of the muscle fibres with the Hereford-Shorthorns which had in most cases been very fat when young These were treated as follows: 1) Allowed sufficient food to permit of a gain of ½ lb. daily (for 6 months); 2) kept at constant weight (for 6 and 12 months); fed so as to allow a loss of ½ lb. daily for 6 and 10 months) i. e. until nearly dying of hunger.

The analytical results presented in Table form indicate the following points:—

Partial starvation does not cause a watery muscular tissue. Fat is almost entirely reabsorbed, while glycogen apparently is not. The character of the protein is altered by a removal of nitrogenous substances amounting to 10 % of the total nitrogenous material, and consisting of albumin nitrogen. The phosphorus content of the flesh is reduced 13 to 15 %.

The liver has a somewhat higher water content in the starved animal and a high nitrogen content. This indicates a greater proportion of amino-acid and extractive nitrogenous substances. The glycogen content is not depleted.

The blood has more water and less total nitrogen in the starved steer: the muscle fibres become very much smaller but still capable of functioning.

The data presented indicate a storage of protein matter in the muscles of the steer.

FEEDS AND FEEDING

1141 – **Rice Straw as Cattle Fodder** (1). — CHIAPPELLI, R., in *Il Giornale di Risicoltura*, Vol. X, No. 9, pp. 131-137 + 1 fig. Vercelli, Sept. 10, 1920.

In Italy, rice straw is usually used as litter and very little as fodder. This is due to the frequent autumnal rains which make the preservation of it difficult, and also to the fact that dry rice straw causes intestinal disturbances. The author shows how these disadvantages can be eliminated.

Rice straw differs from other straw in that it is harvested whilst still green; when air-dried it has the following composition:—

Rice straw is, therefore, relatively rich in the nutrient materials, but these become very indigestible when dried. This can be almost entirely avoided by putting the hay into a silo with a movable cover, under heavy pressure, as in the "cremasco" process (2).

After harvesting and threshing the rice straw is spread in the sun for some days until partially dried, and then put into a silo. In the silo it is mixed with other herbage, also partially dried, that can be harvested at the same time (3). The fodder is ready at the end of one month or

(1) See *R.*, Jan., 1919, No. 115. (*Ed.*)
(2) See *R.*, Jan., 1919, No. 105. (*Ed.*)
(3) See R. Oct. 1920, No 886. (*Ed.*)

Composition of Italian rice straw air-dried.

	Novarese	Bertone	Japanese
	%	%	%
Moisture	14.3	15.0	15.0
Digestible glycogenic substances	17.3	14.4	14.5
Fats	1.9	1.5	1.4
Nitrogenous substances	4.4	3.7	3.1
Total nitrogen	46.3	48.4	50.8
Cellulose	15.8	17.5	15.2
Ash	0.7	0.6	0.5

less, and can be kept several months. It is best to add some concentrated food, such as rice-bran cakes (" pula vergine di riso ") when feeding rice straw to cattle.

1142 – **The Use of Some Salt Water Plants as Fodder.** — PARANJPYE, H. P., in *The Agricultural Journal of India*, Vol. XV, Pt. III., pp. 250-351. Calcutta, May, 1920.

The fodder growing areas in the Ratnagiri district, Bombay, are poor and limited, and the cultivators have to fall back upon such plants as can naturally grow on the poorest of soil and take care of themselves. In the tidal rivers and creeks along the west coast also, there are immense areas which are covered with several kinds of mangroves, with grasses, and holly-like shrubs. These plants grow in salt water, and contain a considerable quantity of salt. They are, nevertheless, fed, even in normal years as green fodder to milch cattle, and if possible, also to work animals. The following examples are given :—

I — The holly-like " *Marandi* " (*Acanthus ilicifolius*) — a spiny plant, 3 to 4 ft high, erect and unbranched The plant is generally cut before its flowers, and chopped into 3 inch bits; then beaten with a strong rod to break down all spines. This is the only necessary precaution in preparing the stuff for feeding Until the animal is accustomed to the new feed, a small quantity of " bhusa " or cotton seed or any other similar food may be added, but these additions may later be omitted.

II. — The " tivir ,, (*Avicennia officinalis*) — a large spineless shrub which covers large areas in the creeks, with peculiar roots which project in large numbers above the surface of the mud. Branches of this plant may be cut and fed to cattle.

III — The " *lavi* " (*Aeluropus villosus*), a small grass about 12-15 inches long, growing in salt water mud. After cleansing, it is immediately fed to cattle, preferably to milch cattle, 10 to 15 lbs per animal. The quantity of this grass available is, however, limited.

The first two plants are very common in all the creeks and rivers of the west coast of India. The cattle owners of the Kolaba, Thana and Surat districts are strongly recommended to use them as long as they are available, and thus increase the supply of fodder.

1143 – **Food Value of Willow Leaves.** — HALL, T. D. (Chemical Laboratory, School of Agriculture and Experiment Station, Potchefstroom), in the *Journal of the Department of Agriculture, South Africa*, Vol. I, No. 5, pp. 456-457. Pretoria, Aug., 1920.

Analyses show that willow leaves are highly nutritious. The samples were taken at intervals of more than a week apart during the feeding experiment conducted by R. BOURLAY with chickens, comparing the value of green willow leaves with green lucerne. In 6 weeks the chickens fed on the former gained 2 lb., in weight over those fed on the latter, — an average gain of 2 $^{2}/_{3}$ oz., per chick. The following Table compares the average composition of dried willow leaves with that of some important hays :—

	Moisture	Crude Protein	Crude Fat	Crude Fibre	Carbo-hydrates N. F. E.	Ash
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Willow leaves (air dried)	10.09	15.37	5.35	19.50	40.4	8.94
Lucerne	8.0	15.5	2. 4	34.8	30.6	8.9
Cow Pea	8.2	13.2	2.4	30.5	39.6	6.3
Teff	8.2	6.0	1.1	34.8	43.2	6.7

It should be noted that the mineral composition of the ash is excellent for growing animals or birds % :— silica 3.268 — iron oxide 3 692 — calcium oxide 31 360 — magnesium oxide 12.620 — potassium oxide 9.926 — phosphoric oxide, 5.04

1144 – **Composition and Food Value of Tobacco Oil Cake.** — See No. 1107 of thist *Review*.

1145 – **Use of Silkworm Dejecta in Stock Feeding.** — RUFFONI, in the *Bollettino del Consiglio Provinciale d'Agricultura, dei Consorzi agrari e dell'Istituto agricolo provinciale di San Michele*, Year XXXIII, No. 40, pp. 3. October, 2, 1920.

In the regions of Italy where silkworms cultivation is of most importance, it is customary to feed their dejecta to the cattle

One ounce of " seed " produces 80 kg , of dejecta, the composition of which varies according to the stage growth of the silkworm ; as can be seen from the analysis by M. GIRARD :—

Percentage composition of silkworms dejecta.

	After the 1st. moult	After the 2st. moult
Moisture	12.10	9.70
Nitrogenous matter	18.21	12.55
Fats	0.79	0.63
Carbohydrates	50.29	59.28
Inorganic matter	8.88	8.72
Cellulose	9.93	9.12

The composition of these dejecta gives them a very considerable value as a supplementary feed, but on account of their great absorbent power, they should be given with caution They are very often fed without dietetic rules, so that they sometimes occasion intestinal disturbances in the stock.

All the disturbances occurring in young animals, viz., an obstinate obstruction of the omasum, often manifest themselves when silkworm dejecta are used as a feed, for they have a strong dehydrating effect upon the mucous membrane of the stomach. The action of the dejecta is thus entirely physical, and if they are kept in good condition, no ill effects due to their composition need be apprehended.

When fed to ruminants, these excreta ought always to be mixed with other foods such as bran, beets, etc., and given in moderate quantities, preferably kneaded into a paste with water. Pigs can eat from 1000 to 1500 gm. daily, either alone or mixed with flour, but always soaked in water. Horses prefer the dejecta dry, and they can be fed to these animals mixed with barley or oats

STOCK BREEDING

1146 - **Sexual Neutralisation Obtained by Means of Orchilytic and Ovariolytic Serums.** — GIULIANI, R. (Direttore Istituto Zootecnico Laziale), in the *Annali d'Igiene*, Year XXX, No. 6, pp. 323-325. Rome, June, 1920.

After briefly examining the advantages and risks attendant upon the removal of the sexual organs, both in the case of the males and females of different species of animals, the author describes a new method by means of which the functioning of the sexual glands can be suppressed without the necessity of a surgical operation.

If cells or cellular extracts of heterogeneous species are introduced into the blood system of an animal, the organism reacts by the production of substances (cytotoxins and cytolysins) which cause the death and sometimes the actual lysis, of the cells of the type used in the injection.

As a rule, these substances only act on the cells of the species of animal from which the injected material was taken. Some, however, have a stronger or weaker action on related species, and also, in the case of animals of the same species, upon tissues other than those which produced the cytotoxins and cytolysins in question.

The experiments consisted, in the first place, in preparing an orchilytic serum from the rabbit. This serum was preferred to an ovariolytic one, the object of the experiment being, if possible, to cause atrophy of the testicles in the animal injected with the serum, since atrophy of the ovaries could only be attained by slaughtering the females.

A he-goat was selected to furnish the serum and was injected periodically with a nucleo-proteid solution of the testicle of a rabbit. Of the 5 rabbits subjected to the action of the serum, 2 died during the experiment; in another which was killed after 15 days, the testicles revealed to the touch that a considerable amount of atrophy had been induced, and microscopic examination showed that the seminal ducts, though still recognisable, contained a kind of granular detritus.

The other two rabbits were subjected to the action of the serum for 30 and 40 days, respectively. During this time, progressive atrophy of the glands of the testicles was observed. When examined, the testicles proved to be to a great extent empty, that is to say, they only consi ted of the albuginea, conjunctive tissue, and a small amount of parenchymatous substance.

Microscopic investigation showed a great alteration in the parenchyma, which was of a finely granular appearance, and in which the seminiferous ducts were difficult to distinguish.

1147 – **Researches on the Inheritance of Coat-Colour in Horses, in Denmark.** — WINGE, O., in the *Nordisk Jordbrugsforskning*, Part. 5, pp. 1-30. Copenhagen, 1920.

A study on the inheritance of coat-colour in horses based on data obtained from the pedigree register, and referring to about 1000 horses of the Jutland breed. Particular note was taken of animals with the 3 fundamental colours black, bay, and chestnut, and also of white and spotted individuals.

The facts observed confirm, to some extent, the theories of WALTHER and WENTWORTH, which however, in the author's opinion, are unnecessarily complicated.

The inheritance of the three colours can be reasonably explained by assuming a single fundamental colour for the three kinds of horses, and by postulating the presence of 2 factors, one R for chestnut, and another S for black. The simultaneous presence of R and S, both in the homozygotic and heterozygotic condition, would determine the bay colour.

There are thus 4 kinds of bay, **R R S S**, **R R S s**, **R r S S**, and **R r S s**; 3 kinds of chestnut, **R R s s**, **R r s s**, and **r r s s**; and finally, 2 kinds of black, **r r S S** and **r r S s**.

Thanks to the large amount of material at his disposal, and by dint of careful examination of it, WINGE was able to prove the truth of his theory, according to which, from the cross chestnut × chestnut, only chestnut foals could be obtained, as has been actually observed; with black × black, both black and chestnut but not bay offspring could be obtained; while bay × bay give foals of any of the 3 colours.

Among the descendants of the bay type, there may be some horses of the formula **R R S S** which, mated with mares of any colour, should give bay foals. Such horses have indeed been known; thus, Nobel No. 295, was the sire of 52 foals all of which were bays.

The fact that, in the Jutland breed, black individuals are much more numerous than bays, makes it probable that the formula for bay is usually **R r S s** or **R R S s**, rather than **R r S S** or **R R S S**.

On the other hand, the three chief colours occur in different shades; there is also a factor for white, and one for spottedness which are dominant as regards R and S.

1148 – **Contribution of Genetics to the Practical Breeding of Dairy Cattle.** — PEARL, R. (Department of Biometry and Vital Statistics, John Hopkins University), in the *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 6, No. 4, pp. 225-233. Easton, Pa., April 1920.

The authors' tests with regard to the egg production in fowls, and milk production in cattle, showed that the phaenotypic performance was an exceedingly unreliable guide to real breeding worth. The real value of the measure of an animal as a breeder is the kind of progeny which it produces, and not the fact that the cow may have herself an enormous record. It has repeatedly been shown that a bull may come from ancestry of the highest performing ability in respect of milk and fat production, but this is no guarantee that his own progeny will be great producers.

Nearly 10 years ago the author began the intensive study of the practical problems of scientifically measuring the breeding worth or value of bulls of the dairy breeds, at the Maine Experiment Station (1) and inaugurated the project of determining the transmitting power of every bull in the Jersey breed recorded up to 1916, as having two or more daughters whose milk producing qualities were known, as well as the producing abilities of the dam.

This article gives a brief account of the scope of the work and some of its chief results. The author notes that, stated specifically if $D\,d$ represents the milk production of a daughter of a given bull, and $D\,n$ the milk production of the dam of this daughter, then the measure of this bull's transmitting qualities for milk production in respect of this pair would be:

$$\textit{Sire's transmitting power} = D\,d - Dm.$$

A Table gives in detail the net average change in butter fat production of daughters as compared with dams, and enables the breeder to form a real judgment of the worth of various bulls which appear in the pedigree of Jersey Cattle. Reference is made to the complete paper which also discusses the relation of inbreeding, and the amount of Island bred stock, etc., to production and a summary is then given of the chief results of the whole study:—

There are 224 Jersey Registry of Merit sires which meet the requirements of this performance test for their transmitting qualities in milk production. Less than one half raise the milk production of their daughters over that of their latter's dams. The largest number of the daughter-dam pairs is 39 for one particular sire Hood Farm Pogis 9th.

Out of the 225 sires which met the requirements of the daughter dam performance test for transmitting qualities of butter-fat percentage, 101 raised the latter of their daughter's milk compared with the percentage of that of the dams of these daughters.

The leading sire in this test raised his daughters on the average 1.338 % of butter fat, and had two daughter-dam pairs. Hood Farm

(1) See *Maine Agr. Exp. Sta Ann. Report for* 1919, pp. 89-204. (*Ed.*).

Pogis 9th leads in the number of daughter dam pairs with 42, and raised the butter fat percentage of his daughter on the average of 0.243 % over that of the latter's dams. Out of the 224 sires, only 99 were found to raise the butter fat production of their daughter's over that of their dams, and only 69 out of 159 sires had sons which showed similar results.

The sires are classified into two groups: 1) inferior sires, when they lower the milk production and butter fat percentage of their daughters as compared with the same variables in their dams, and 2) superior when showing the opposite results. The fact that 47 sires are included in Group I compared with 28 in Group II emphasises the need of exact knowledge of the transmitting qualities for the above mentioned percentages.

Inbreeding coefficients show that the sires of superior merit have 7.08 % of the greatest possible inbreeding up to the fifth generation. The inferior sires are inbred 9.65 % of the greatest possible amount (continued brother and sister mating). An analysis of pedigrees shows that there is little or no difference in the amount of relationship between the sire and dam of the individual bulls in the two groups. Amongst the Island bred Jerseys and the American bred Jerseys, the mean number of Island males and females in the pedigree of the superior sire's group were shown to be 6.94 and 6.55 respectively. The animals which appeared in the pedigrees in the first case more than 4 times, or in the second case more than 3 times, had appearances in the pedigrees of the sires inferior in their transmitting qualities. This fact alone makes it clear that the appearance of certain famous animals in the pedigree of a given bull is no guarantee of that particular bull's worth.

1149 – **The Relative Importance of Heredity and Environment in Determining the Piebald Pattern of Guinea Pigs.** – WRIGHT, S. (Bureau of Animal Industry, United States Department of Agriculture), in *Proceedings of the National Academy of Sciences*, Vol. 6, No. 6, pp. 320-332, figs. 6, Easton, Pa., June, 1920.

The Bureau of Animal Industry has been carrying on an experiment on the effects of inbreeding on guinea pigs since 1906. Twenty-three families were started successfully from as many pairs and were maintained wholly by matings of brother and sister. Another stock from the same source has been maintained as a control, without mating even second cousins.

A number of colour variations were present in the original stock, although these consisted largely of tricolours, and most of them kept appearing during the early history of each family as a result of Mendelian segregation. After a number of generations, however, a certain colour became fixed automatically within each inbred line, and the families became broken into a number of sub-families each characterised by a particular colour.

As a supplement to more direct attempts to determine the cause of these variations in the pattern, it seemed desirable to find the relative importance of heredity and environmental factors.

In this paper, only variations in the piebald pattern are considered, and the sexes dealt with separately. Only the dorsal areas are taken into

account. As the correlation between the amount of white on the back and belly is 0.86, and the back contains the most persistent centre of colour (the ear region), and almost the most persistent white (the nose), the grades, based on the dorsal part only, are believed to be practically as satisfactory as grades based on the entire coat.

Figures illustrate the distribution of grades of white in three of the inbred families, and in the control stock 1916 to 1918 curves represent the distribution of colour potentialities among areas in the skins.

Two stocks were chosen for special study. One was the control stock, with random matings, (except that even the mating of second cousins was avoided). The other had since 1915 been descended entirely from a single mating in the twelfth generation.

Inspection of the Tables given shows that sex makes no significant difference in the correlations. This is in agreement with the results of direct experiments. Reciprocal crosses between inbred families at the opposite extremes, produced practically the same result, the progeny being in both cases, almost exactly intermediate. Sex also makes no significant difference in variability. In the case of the means, there is, however, a sex difference. The mean and standard deviations are measured on a scale in which unity is the standard deviation of colour potentialities for areas within the skin of a single average guinea pig. Even the random bred types differ less among themselvs in this respect than the spearate skin areas of a single animal.

The correlations between parents, between parents, and offspring, and between litter mates in random bred stock and a single inbred family (No. 35) 1916-1918 are tabulated, and also illustrated diagrammatically. There is evidently very little genetic variability left in family 35, but a good deal in the control stock. The main differences which are not genetic must be due to irregularities in development due to the intangible sort of causes to which the word chance is applied. Variations which are due to inaccuracy in grading, and are therefore, merely apparent, cannot, however, be distinguished from those of this class. Checks have been made which indicate that apparent variability due to this cause is small in comparison with the large amount of variability which is found to be due neither to heredity, nor to tangible environmental conditions.

In a forthcoming paper, a method of estimating the degree to which a given effect is determined by each of a number of causes will be discussed at some length.

The progeny of a cross between two grades of piebald are almost exactly intermediate on the average, and the second generation is only slightly more variable then the first. These results might be due to to groups of dominant factors with opposed effects. The most probable explanation is that dominance is lacking, and the author adopts this view provisionally.

In the control stock, variations in pattern are determined, about 42 % by heredity and 58 % by irregularity in development, leaving no-

thing for tangible environmental factors. In the inbred family, the corresponding figures are 3 % heredity, 5 % for tangible environment and 92 % for irregularity in development. The mean squared deviation due to each kind of factor can be found by applying these percentages to the total squared standard deviation of each stock.

HORSES

1150 – **The Indices of the Horse.** — ROUARD, M. (Remount Dépôt at St. Jean-d'Angely), in the *Revue vétérinaire*, Vol. LXXII, Series 3, No. 1, pp. 539-548. Toulouse, Sept, 1920.

The index of compactness, and the dactylo-thoracic index have recently become of great practical importance.

Index of Compactness. — This is obtained by dividing the weight of the horse by its height in centimetres: $IC = \frac{P}{T}$. A better definition would be the following: the index of compactness expresses the weight of 1 cm., of height. Thus, if a horse weighing 620 kg.), measures 1.62 m., its index would be 3.80, that is to say, each cm., of height weights 3.80 kg.

It has long been allowed that this index was the ratio of the weight to the number of centimetres exceeding the metre. Thus, in the prexceding example, we should have $IC = \frac{620}{62} = 10$. Whereas stud stations, and racing clubs 62 use the formula $IC = \frac{P}{T}$, the Remount Service uses $IC = \frac{P}{T-100}$, because the commissions which studied the artillery-horse type before the war were of opinion that this index was the more mathematical.

In the following table, obtained with the formula $IC = \frac{P}{T}$, it can easily be seen that instead of varying between 2.50 and 3.08, IC varies between 7 ½ in the case of light cavalry types, and between 8 ½ and 9 ½ in that of artillery horses.

Type	Height metres	Weight kg.	Index of Compactness	Observation
Light horse	1.51	380	2.50	Young remounts
Dragoon	1.56	416	2.60	id.
id.	1.57	431	2.70	Adult horses
Cuirassier	1.64	500	3.04	id.
Artillery	1.50	450	3.00	Height between 1.50 m. and 1.55 m.
id.	1.57	480	3.07	Height between and 1.66 m. 1.61 m.
id.	1.62	500	3.08	Height above 1.61 m.
Draught	1.60	480	3.00	—

The index of compactness gives information principally regarding size and volumetry; given equal height, it is larger in proportion as the

weight is greater, and inversely; in the same way, the weight being equal, it will be larger in proportion as the height is less, and inversely. When this is high, this denotes great density of the tissues, the mass, and the frame, all very important factors in judging a horse.

The author basing his calculations on numerous weighings and measurements made in the cavalry and artillery regiments, and in the remount stations, has endeavoured to determine the average value of this index of compactness in the different classes of Army horses.

The limits within which the value of the index of capacity varies seem to be as follows:— 2.50 for light horses, 3.00 for medium horses, and 3.08 for heavy horses.

In some cases, the index is as much at 3.50, and not infrequently it rises to 3.70 and 3.80 in some large half-blood or draught stallions.

Examination of the Table shows that the value of IC rises from that of the light category to that of the artillery horses, by way of the dragoon and cuiraissier mounts, and reaches its maximum in the heavy draught horses. This is natural, for the compactness of a horse depends upon the development of its muscular masses. The lower compactness index of the pure-bred horse, whether a light mount or a drago n charger, is, however, not simply due to insufficient muscular development, but is a proof of the physiological fact that the strength and intensity of muscular contraction do not solely depend upon the number of the muscle fibre but also upon their quality and the richness of their nerve supply.

The knowledge of IC does not serve only in judging an isolated individual, but very useful information can be obtained by observing the changes that take place in this index in the same lot of young horses during one year. The extent of the increase and the rapidity of the change, show the value of the rations, the amount of work to be required from the animal, and the suitability of the district for horse-breeding.

DACTYLO-THORACIX INDEX (Idt.). — This is given by the proportion between the circumference of the cannon-bone and the perimeter of the thorax. The measurement of the circumference of the cannon-bone does not merely give us information as regards the region that is measured but tells us much about the general development of the bones and tendons.

The results obtained by the author from his examination of numerous horses are as follows:—

Type	Circumference of cannon-bone	Perimeter of Chest	Idt.	Ratio	Observation
	cm.	cm.			
Light horse	18	1 72	0.104	1/9.5	—
Dragoon	19	1 78	0.106	1/9.5	—
Cuirassier	21	1 85	0.108	1/8.8	—
Artillery	19.7	1 78	0.110	1/9	Small: 1.50 m.
id.	21	1 82	0.110	1/8.7	Tall: 1.62 m.
Draught	20	0 11	0.112	1/8.8	—

These figures confirm the data already accepted.

The ratio part of the circumference of the chest should always be less than the total circumference of the cannon-bone, and never exceed 1 to 1 cm.; if it is more, the animal may be considered as deficient in bone development.

Austria 1911 - Cattle Breeding and Milk Production in Austria. — [illegible] by M. H., Director of the Agricultural Experimental Station for the Alpine Region, Vienna. Published by the Imperial Royal Central Commission for Agriculture. Vienna, 1913. 8vo, 1 + 1 + 1 +

This decrease in the number of cattle is due to different causes. Before the war, cattle-breeding was hindered by frequent epidemics of epizootic aphthic fever and by the spread of contagious abortion. The high price of cereals caused these crops to be more extensively cultivated, whereas the low price of milk discouraged milk production. The increasing use of fertilisers made cattle-rearing appear superfluous from the point of view of manure-supply, and caused horses to be substituted for draught-cattle. In many farms, the cattle were replaced by pigs, the latter being thriftier and more prolific. A large number of high mountain pastures were bought by hunters, who replanted them with trees and kept them for hunting-preserves. (See H. KAINDLSTORFER: The Decrease of Small Rural Holdings and the Legislation for the Control of this Phenomenon in Austria. *International Institute of Agriculture: Monthly Bulletin of Economic and Social Intelligence*, April 1921.)

As a rule, however, it was only the number of cattle that decreased, and not their quality. There was, indeed, an increase in live-weight and milk production; therefore, the diminution in the number of head would not in itself have been sufficient to render it difficult to supply Austria with milk. On comparing Austria with Switzerland, it can be seen how little the number of head of cattle had to do with the matter. Even when the number of cattle was at its lowest in 1918, there were more of cattle per 1000 inhabitants in Austria than in Switzerland: viz. 333 as against 321. (See DUBOIS: Das Ernährungsproblem Oesterreichs in *Wiener Klinische Wochenschrift*. Parts 17 et seq., 1919.)

The conditions created by the war which influenced the number of cattle in a decisive manner, as well as those indirect influences we have just mentioned, were of totally different character. In the first place, the scarcity of food due to the increasingly severe blockade, drove cattle-owners to slaughter a much larger number of animals for their own consumption. Further, large quantities of hay and forage-straw were requisitioned for military purposes, and bran could only be bought in small quantities and that was of inferior quality. Other concentrated foods that had formerly been used in all the farms often in considerable quantities, were not to be found, or only to be obtained in very limited amounts; in fact, the breweries that formerly furnished malt and brewer's grains were themselves without barley while no raw material from abroad arrived at the oil-factories. The cultivation of sugar-beets diminished rapidly and this entailed the decrease of pulp and molasses, both of which had previously formed an excellent and much appreciated feed for milch cows. The diminished and ill-nourished stock produced less manure, and the small quantity obtainable was employed solely for the fields, none remaining for the meadows and pastures. Again, as the scanty store of fertilisers was also reserved for the fields, the forage crops suffered from the lack of nutritive substances, and their yields were very low. In addition, bad weather prevailed throughout the war. As a rule, the weather was dry during the vegetation period of forage crops, which prevented them from developing properly and when the time for cutting

arrived, the rain damaged the hay, often entirely spoiling it. As most of the men between 17 and 50 had joined the colours, labour was lacking everywhere; this was all the more serious because milking-machines and many other machines used in the dairy industry were almost unknown in Austria, and the old-fashioned construction of the cattle-sheds permitted of no labour saving devices. In a large part of Austria, the cattle are all stall-fed, so that labourers are required to cut, load, transport and distribute all the forage used. Ensilage so common in North America, is hardly known in Austria. Beetroot pulp and crowns, which are the only feeds preserved in heaps, are not ensilaged, but put into pits, which is perhaps less practical from the labour point of view. Lack of labour also prevented the regular supervision of the meadows and forage crops, and of the drainage ditches, so that the forage suffered both in quality, and quantity.

All these circumstances rendered cattle rearing very difficult in every respect. The great hindrance in the development of this industry was, however, the military requisition of beef cattle. When the stock of these animals was exhausted, it became necessary to fall back upon young animals, and later even upon milch cows. The cattle owners sacrificed their cows in order to fulfil their obligations, though this was contrary to the orders of the military authorities.

Before the war, Vienna was almost entirely supplied with meat by Hungary, only a small quantity coming from Galicia, while the amount furnished by regions which constitute the present Austria, was very little. In 1913, Austria and Galicia only provided 45 896 animals towards the consumption of Vienna which amounted to between 4200 and 5000 head of cattle weekly (see "Statistik der Gemeinde Wien, für das Jahr 1913" Vienna, 1915, and Dr. MESSNER, "Die Viehproduktion und die Fleischversorgung in Oesterreich-Ungarn", Munich, 1915). During the war, Hungary almost entirely suspended her consignments of cattle. None could be supplied by Galicia, which for years was the theatre of the war. It therefore devolved upon the Alpine districts (in addition to their other obligations towards the military authorities) to supply Vienna with the necessary quantity of meat. This could only be done by greatly lowering the quality of the beef cattle, and by cutting down the meat ration per inhabitant to a considerable extent. According to the *Wirtschaftsgeographische Karten und Abhandlung zur Wirtschaftskunde der Länder der ehemaligen osterreichisch-ungarischen Monarchie*, Vienna, 1919, the average weight of beef cattle in 1919 was 120 kg., as against 250 kg., before the war, and the weekly meat consumption per head was 0.125 kg., instead of 1.54 kg. In the three summer months of 1920, the cattle sent to Vienna amounted to only 8918 animals from Lower Austria. Many animals slaughtered scarcely weighed 80 kg.

All these consignments of cattle had consequences that were all the more serious seeing that, owing to agricultural conditions, it was impossible to raise calves to make up the depleted herds. In Lower Austria, out of 100 stock owners 35.8 possessed but one or two head of

cattle, and had neither the land nor the means necessary for rearing calves.

The handing over of the milch cows, in accordance with the provisions of the Treaty of St. Germains, was a particularly serious blow to agriculture.

The feeding conditions had become worse, *pari passu* with the decrease in the number of cows, which had fallen a little more since the census of 1918 ; this can easily be understood after all that has been said regarding forage production, and consequently the milk yield was affected, although the farmers tried to consign the inferior animals and retain the good milkers.

To the author's knowledge, the milk production has fallen to at least half the usual amount in all dairy-farms.

The following, data, taken from the books of a large and well-managed establishment, may serve as an instance :—

1913-1914	2 880	litres of milk
1914-1915	2 686	» »
1915-1916	2 188	» »
1916-1917	2 393	» »
1917-1918	1 878	» »
1918-1919	1 324	» »

(These data refer to all the cows, and therefore include cows not in milk and young heifers).

This decrease in milk production is observable even where the most scientific and modern methods of cattle breeding are adopted, and where only pedigree cows are kept, the inferior animals being rejected. According to the *Jahresbericht für das Jahr* 1918, the average annual milk yield of the cows under the supervision of the " Verband der Murbodner-Murztaler Viehzuchtgenossenschaften in Steiermark " from 1910-1918 was as follows :

Years	Milk	Fat content of milk	Butter
	kg.	Per cent.	kg.
1910	1897	4.04	83.66
1911	1957	3.95	84.75
1912	2053	4.02	90.16
1913	2097	4.05	92.80
1914	2215	4.03	97.56
1915	2238	4.03	98.50
1916	2232	3.94	95.98
1917	2152	4.01	94.26
1918	2181	3.93	93.56

The highest milk yield of any cow under the supervision of the above-mentioned association was :—

In 1914	5 356 kg.
» 1916	4 615 »
» 1917	4 580 »
» 1918	4 487 »

This shows the bad effect of poor feeding upon the milk production, even of the best milch cows. M. Stockler, Secretary of State for Agriculture, considers that the average milk yield of a cow has fallen from 15 to 6 litres ("Sitzung des österreichischen Nationalrates vom Mai, 1920"). M. Löwenfeld-Russ, Secretary of State for Food (see also his work entitled *Ernährungswirtschaftliche Gegenwartsprobleme*, Vienna, 1920), estimates that the total milk production of the 915 327 cows possessed by Austria is only 11 487 000 quintals per annum, a miserable amount when compared with the Swiss milk yield in the same year. In fact, in M. Schneider's work *Darstellung über Erzeugung und Verbrauch von Nahrwerten in der Schweiz*, published in 1917, the annual milk yield of the 739 922 cows possessed by Switzerland is estimated at 24 705 000 quintals; this high figure is primarily due to the excellent system of breeding and cattle-management that has been practised for centuries.

To sum up. it can be said that the farmer obtains much less milk from his reduced number of cows, of which the yield has considerably diminished, than he could count upon if the sheds were full of animals. At the same time, his household consumption of milk has risen, owing to the difficulty, and sometimes even the impossibility of procuring other food. The stock-owner also eats much more butter than formerly, when his pigs were fed on good concentrated food and produced more fat than they do to-day. Owing to the scarcity of other suitable food, the calves and other young stock are given more milk than before, so that there is much less milk on the market, and the dairies receive scarcely $^1/_{10}$ of the amount sent to them previous to 1914.

It should further be added that neighbouring countries, which formerly sent their surplus milk (about 300 000 litres per day) to Vienna, have prohibited the export of this commodity, which shows how serious a problem the milk supply of that city has now become. Whereas, before 1914, Vienna, with 2 million inhabitants received on an average 900 000 litres of milk daily, during the winter 1919-1920, it only received 60 000, and in April, 1920, before green forage was used, only 30 000 litres (according to information furnished by the "Milchwirtschaftstelle der Stadt Wien". Similar or even worse conditions also exist in some provincial towns and industrial centres.

In spite of the reduced amount of milk, the expenses of the industry have not diminished but increased, owing to the higher salaries and wages of the employees and labourers, and the greater cost of the upkeep of buildings and of the feeding of draught animals. This increased

outlay, together with the high prices of food-stuffs and raw material, has contributed to the extraordinary rise in the price of milk.

1152 – **A Comparison Between Sheep-Breeding and Cattle-Breeding.** — GOVIN, R., in the *Journal d'Agriculture pratique*, Year LXXXIV, No. 42, pp. 309-310. Paris, October, 14, 1920. SHEEP

The author proposes to see, when sheep or cattle are kept under similar conditions, which of them pays best for the forage consumed, He leaves out of the question sheep living under conditions suited to them alone such as on waste land, stubble, the poor pastures of arid regions, or on steep slopes.

Whereas in the case of other animals their wants increase as their bodies grow, the sheep needs less as its body surface becomes larger. An ox 500 kg., in weight, requires when doing no work, sufficient food to supply 11 500 calories ; the surface of its body being about 6 sq. m., this means 1916 calories per sq. m. ; 10 sheep of 50 kg., also representing 500 kg., of live weight, only need 15 000 calories, or 1153 per sq.m.; which is about 60 % less per surface unit than the ox.

The maintenance of 500 kg. of sheep requires food producing 3 500 calories more than is needed for the support of 500 kg. of ox.

Thus, the cost price of mutton is very considerably higher than that of beef. What is necessary is, that it should fetch a higher price that is in proportion to its cost ; this proportion is :—

$$\frac{\text{cattle}}{\text{sheep}} = \frac{11\,500}{15\,000} = \frac{77}{100}$$

Before the war, the current prices per kg., of live weight were :

$$\frac{\text{cattle } 0.75 \text{ fr}}{\text{sheep } 1.20 \text{ fr.}} = \frac{62.5}{100}$$

It paid better to feed cattle. The extreme and average prices at the markets of La Villette in October, 1920, were :—

$$\frac{2.75}{4,40} = \frac{62.3}{100} \qquad \frac{4.10}{5.70} = \frac{74}{100} \qquad \frac{5.43}{6.96} = \frac{78}{100}$$

To this must be added the profit from the sale of the wool.

It appears from these figures that it is quality that pays, and this is found in the ox, which was produced on the pasture or on the farm with the same food as fed to sheep. In this comparison, the lowest prices need not be taken into consideration, for these are only paid for sheep to be exported, or for those that eat forage which is of no use to cattle.

1153 – **The Decline in Sheep Breeding**— REW, SIR H. in *The Journal of the Ministry of Agriculture*, Vol. XXVII, No. 5, pp. 450-455. London, August 1920.

The author deals with this subject from the point of view of statistical facts and economic tendencies and not from the practical standpoint

The annual returns summarised in quinquennial periods show that the total stock of sheep in Great Britain has varied as follows, the numbers representing millions :— 1870-74, 28.6 ; 1875-79, 28.4 ; 1880-84, 25.3 ; 1885-89, 25.8 ; 1890-94, 27.6 ; 1895-99, 26.6 ; 1900-04, 25.9 ; 1905-09, 26 3 ; 1910-14, 25.4 ; 1915-19, 23.7. This indicates the substantial fall during the present century, quite apart from the war period which is considered later. It should however be noted that the age at which sheep are slaughtered is on the average now considerably less than it was fifty years ago and it is evident that with the progressive adoption of this principle the number of sheep returned each year would decrease even though the actual number bred were maintained. This is obvious from the records of the average numbers of ewes returned during the past 25 years, in millions : 1895-99, 10.0 ; 1900-04, 10.1 ; 1905-09, 10.3 ; 1910-14, 10.1 ; and 1915-19, 9.6.

A comparison is then made between the pre-war position and the succeeding years up to 1919 of the total number of ewes and other sheep, the figures again representing millions : 1914, 24.3 ; 1915, 24.6 ; 1916, 25.0 ; 1917, 24.0 ; 1918, 23.4 ; 1919, 21.5.

There are three factors to which the recent decline of sheep breeding has been attributed : 1) Special economic conditions ; 2) control of prices, distribution and sale by the State ; 3) extension of arable cultivation.

With regard to the first, this naturally ensued owing to shortage of labour and increased cost of feeding stuffs, but it was in 1917 that the other factors were intoduced. The author states that if the State chose to take over the management of all the flocks, with all that this implies it could then determine regardless of economic considerations, how many ewes should be put to the ram each year, and thus control production. Otherwise the control of prices and of distribution must finally reduce the number of sheep kept.

While the cost of production increased on arable land to a much greater extent than on grass land, the arable sheep farmer was prevented from obtaining the higher prices for the lamb and mutton produced which would have been fetched in a free market. But, if the importance of extending the arable area and increasing the production of cereals is recognised, it should also be recognised that one of the means which will assist in securing that end is to ensure that confidence be restored to the sheep breeding interest which has for so long been the mainstay of British agriculture

1154 – **Sheep in Tunisia.**— *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. VI, No. 20, pp. 710-711. Paris, October, 13, 1920.

The Minister of Foreign Affairs communicates a report made by the Resident-General in Tunisia upon the measures adopted in the Protectorate for the encouragement of sheep-breeding.

On various occasions, Shows have been organised, with prizes in kind for the exhibitors of the best flocks of sheep for breeding purposes. In addition a model sheep-farm has been established at the Sidi-Tabet Stud

Station, for rearing pure-bred sheep of the Chatillonnais Merino, the Arles or Crau Merinos, and thin-tailed Algerian breeds. These animals will be ceded to French or native breeders, with a view to propagating the breeds of sheep most adapted to the soil and climate of the different regions. The General Directorate of Agriculture likewise proposes to establish sheep-breeding stations in the best sheep-rearing districts, and when necessary to make an appeal for assistance to private owners of large estates.

Finally, grants of land have been made in Tunisia to persons undertaking to keep sheep upon it. They are also required to construct shelters for their flocks, and to dig wells, in order to ensure a sufficient supply of water.

1155 - **Sheep Raising in Ontario, Canada.** — TOOLE, W., and SACKVILLE, J. P., in *Ontario Department of Agriculture, Ontario Agricultural College, Bulletin* 274, pp. 1-56. Toronto November, 1919.

The number of sheep in the Province of Ontario in 1911 amounted to 1 046 456 ; in 1911 the number was reduced to 742 188. During the War period, owing to the enhanced prices for wool and mutton, the number increased to 972 341. A general classification of the breeds is made according to fleece, the two classes being known as the *medium wool* and the *coarse* or *long wool* breeds. In Class I is included : Shropshire, Southdown, Oxford Down, Hampshire, Suffolk, Dorset Horn and Cheviot ; in Class II : Leicester, Lincoln, Cotswold and Romney Marsh.

It is absolutely essential to maintain a good pure-bred sire which should possess all the best characteristics combined with proper type and conformation. In addition to this the ram should possess abundance of vigour and vitality. The fleece will depend on the particular breed to which he belongs, but in all breeds, the density, and quality and length should be taken into consideration. In selecting a ram preference is often given to a twin, hoping by this means to obtain further twins. There is considerable difference regarding the age at which a ram should start breeding. In any case, flocks ranging from 6 to 20 will give satisfactory results provided they are judiciously handled, but a mature ram will care for a flock of from 40 to 50 ewes.

The rams should be kept in good vigorous condition at all times of year. A short time before the breeding season, it is advisable to give a light feed of grain once per day, and a supplement of ration consisting of 2 parts oats + 1 part bran can safely be fed at the rate of 1 to 3 lb., per day per ram. The rams may mix with the ewes during the day time, but must be separated at night.

The ewes should also be selected with care, and should show all the desirable characteristics, of fulness of form, strength and vigour, combined with feminine character. Those with broken mouths, defective udders should be discarded, and those retained should receive good care, so that when the breeding season comes they are in good condition and will give birth to lambs in a vigorous way.

The feeds will consist in concentrates, roughage and silage, roots and pasture grass. The concentrates which give the best results are: maize, gluten feed, wheat (not often used owing to high cost), wheat bran, oats, oat hulls, bran etc., the following are also equally useful, but are given in smaller quantities :— barley, brewer's grains, malt sprouts, rye, millet, buckwheat, cottonseed meal, linseed meal, peas, beans, tankage, etc. ; alfalfa and red clover are the two best roughage feeds. Maize silage is quite commonly fed. Pastures containing red clover, alfalfa and rape are the most satisfactory.

The main feature in housing sheep during the winter is that their quarters should be dry, and free from draught. As the ewes must have plenty of exercise, a large yard should surround the pen. It is good policy to make as much use as possible of the cheaper, more bulky feeds. Dry roughage in the winter, green forage in the spring and summer, prove satisfactory. For a regular summer pasture, it is advisable that sheep should be kept on land that is comparatively high and dry. Rape has always been regarded as an excellent pasture. When the pasture becomes very short and dry, lambs will doubtless make good use of a light grain ration. The lambs should be separated from the ewes when between 4 and 5 months old. A rape pasture makes an ideal pasture for lambs after weaning.

Spring dipping is practised as a general rule immediately after shearing, and again in the autumn. In order to keep the flock in healthy vigorous condition, and obtain good quality wool, it is important that they should be kept free from ticks and lice.

In order to obtain quantity and quality as regards wool, it is essential that the flock be maintained throughout the year in good condition. A good growth of wool depends entirely on adequate nourishment and management in general. Wool produced during a period of sickness or low condition of the sheep is bound to be weak in fibre.

1150 - **Bureau of Animal Industry Range Sheep Experiments.** — MARSHALL, F. R. in the *National Wool Grower*, Vol. VII, No. 1, pp. 35-36, 1917 ; Vol. VIII, No. 1, pp. 35-37, 1918 ; Vol. X, No. 1, pp. 17-19, 1920 ; abstract in *Experiment Station Record*, Vol. XLII, No. 9, pp. 868-869. Washington, D. C., 1920.

I. — BUREAU OF ANIMAL INDUSTRY RANGE SHEEP EXPERIMENT. — A brief summary of some records of the experimental work with range sheep conducted by the U. S. Department of Agriculture at Laramie, Wyoming.

During the years 1910 to 1915, 72.8 % of the yearling ewes lambed, and of these 86.5 lambed again as two-year-olds. Of the ewes which did not lamb as yearlings 88.8 % had lambs the following year.

For three successive years a lot of 17 ewes were hand-shorn and a similar lot machine-shorn, and for two years another lot of 12 were hand-shorn and a similar lot machine-shorn. The records indicated that after two years, fleeces of sheep shorn by machine had increased in weight over the hand-shorn fleeces to an extent, which, in the author's opinion, can not be attributed entirely to closer shearing. Two years' records also

showed heavier fleeces from folded than from plain-wool sheep, but the wool was longer in the latter fleeces.

II. — SOME EXPERIENCES IN BREEDING RANGE SHEEP. — Tables are presented showing the relation of fineness of wool in Rambouillet ewes to grease weight of fleece and length of wool, based on records secured by the Bureau of Animal Industry of the U. S. Department of Agriculture at Laramie, Wyo., in 1915 and 1916. It is also noted that the percentage of lambs produced was higher and the proportion stillborn or dead within a week was lower in the case of the Lincoln × Merino crossbreds than in the case of pure bred Rambouillets and Corriedales.

RESULTS OF EXPERIMENTS WITH CROSSBRED RANGE SHEEP. — Results secured by the Bureau of Animal Industry of the U. S. Department of Agriculture since the transfer of the sheep experiments to Dubois, Idaho, in 1917, are summarized.

The F_3 generation of the Lincoln × Rambouillet cross form a desirable and fairly uniform strain for which the name Columbia is proposed. Each generation is mated inter se. It is thought that after a few more generations the Columbias will be entitled to consideration as a distinct breed.

1157 – **Open air Pig-Keeping.** — *The Journal of the Ministry of Agriculture*, Vol. XXVII No. 5, pp. 456-457, figs. 2 London, August, 1920. PIGS

Open air pig keeping has been successfully carried out in England on poor London clay which had been allowed to fall into bad condition, and was not capable of raising good crops. The animals are penned with iron hurdles or chestnut pales and it is found that 1 acre will carry 10 pigs for 6 months. These are treated like sheep and after the necessary preliminaries, are allowed to fallow unattended. Breeding is arranged to suit the weather and so that the sows farrow in January and July. For sows with a litter, 7lb., per day of concentrated food is the maximum allowance. The ration consists of the following mixture %: — fish meal 10; barley meal 28; middlings 20; palm kernel meal 40; maize germ meal 10.

No ringing is practised and the pigs are not fed before being turned out. Pigs born in midsummer 1919 were wintered on rape and given 4 lb., per head daily of the mixed meal and a fresh fold of rape every third day. In February they were put into an orchard and given an extra ration of 2 lb., of beans every week and in March, run wild over young wheat and winter peas and fed at midday with the 4 lb., ration as above. In April and May they were folded on rye, with possible necessary additions of peas or beans, but never exceeding the 7 lb., limit.

Catch crops are raised throughout the year, and rape, kale and clover are found the most useful in preference to rye and tares. It is claimed that pigs graze more closely than sheep. Many 5 months old gilts folded on rape and clover with a 3 lb., daily ration, are fat enough to kill. The early January gilts farrow when 13 months old. There have been no cases of tubercle, and no deaths in farrowing. Ordinary winter weather has had no bad effects.

One of the most important effects is the beneficial effect on the land. In this particular case the whole of the agricultural position has greatly improved and heavy crops of corn are grown where it was before impossible.

1158 – **Winter Rations for Brood Sows.** — Robison, W. L., in *Monthly Bulletin of the Ohio Agricultural Experiment Station*, Vol. IV, No. 12, pp. 363-368, figs. 2. Wooster, Ohio, 1919.

Three experiments are reported involving comparisons of supplements to maize and legume hay as winter rations for pregnant sows. They were begun in December, 1915, January, 1918, and January, 1919, respectively, and each sow was continued on the experimental rations until she farrowed. The combined result (including those from 3 lots, one fed on tankage, another linseed meal, the third skim milk and the last oats) are summarized as follows :—

Comparison of supplements to rations for brood sows.

Supplement	Number of sows	Daily ration			Weight per sow		Daily gain per sow	Pigs per litter	Average birth weight per pig	Daily cost of rations	
		Ground corn	Supplement	Legume hay	Initial	Final				Gross	Net *
		lb.	lb.	lb.	lb.	lb.	lb.		lb.	cents.	cents
Bone	14	4.02	—	2.55	398.7	450.0	0.60	12.6	2.27	12.6	9.2
Tankage	37	3.75	0.31	2.55	391.9	457.4	0.84	11.9	2.24	13.6	7.3
Linseed Meal	7	5.24	0.37	1.53	398.9	479.8	0.87	10.2	2.45	16.1	8.4
Skim milk	15	4.23	10.14	1.87	405.6	496.2	1.22	11.0	2.31	18.5	7.3
Oats	7	2.47	2.47	1.54	437.7	504.7	0.85	11.6	2.29	13.3	7.0

* Gross cost less value of daily gains at 12 cts a pound.

Maize was charged at 2.5 cents a lb., oats at 2.25 cents a lb., skim milk at 60 cents per 100 lb., linseed meal at $80 a ton, tankage at $110 a ton, and hay at $20 a ton.

The author holds that sows should gain in body weight during gestation, and points out that seemingly expensive rations may in reality be cheap if credit is given for gains. It is also noted that oats when low in price with respect to maize may be used as a partial substitute for the latter.

POULTRY

1159 – **The Economic Position of the Poultry Industry.** — Brown, E., in *The Journal of the Ministry of Agriculture*, Vol. XXVII, No. 5, pp. 458-462. London, August, 1920.

The main factors in the increased prices of eggs and poultry in England, especially the former, are the great decrease of imported supplies. The following Table prepared from figures given in the Trade and Navigation Returns of the Board of Trade, demonstrates this fact :—

Country	Eggs in Thousands of Gt. Hundreds *		Poultry, dead. cwt.	
	1913	1919	1913	1919
Russia	11 453	—	119 944	8
Denmark	4 265	1 638	—	—
Germany	514	—	—	—
Netherlands	977	—	—	—
France	702	6	31 175	3 083
Italy	846	—	—	—
Austria–Hungary	884	—	26 674	—
U. S. A.	6	1 409	54 242	100 512
Egypt	1 096	759	—	—
Canada	2	1 477	—	—
Other Countries	835	355	46 430	43 964
Total	21 580	5 644	278 465	147 567
Decrease per cent.	73.8		47.0	

* Great hundred of eggs.

The three countries which have sent the greatest volume of supplies since 1914 are Egypt, Canada, and the United States. As far as can be anticipated, imports from the two first will continue unless prices fall very heavily but it is unlikely that the same quantity will be received from America. As the imports from all three in 1919 only represented 17 % of the total imports of 1913, they do not present a serious factor in competition with the home market. Before the war 56 eggs per head of the population were imported, while in 1918 and 1919 the imports were respectively 7 and 14 eggs per head. This indicates not only the imperative need for production to meet the shortage of imported supplies, but also to provide for an anticipated increased demand. In the opinion of the author, an increase of about one and one-third of the total number of adult fowls would make up for the reduction in imports. Extension of production is advocated on an open range where the costs of feeding and equipment are comparatively low One of the effects of the war has been to stabilise commercial poultry farming for egg production and economically this aspect of the industry is one of the most promising and has encouraged the idea also of domestic poultry keeping. The high prices obtainable for stock may be held to have considerably strengthened the position of breeding farms.

There is, however, a comparative lack of knowledge and a need for extension and development of scientific experimental work and inquiry into the causes of and prevention of diseases. Efficient training and instruction among the rural population is very much needed, and the proposed National Poultry Institute should be worked on these lines.

1160 – **The Bourbonnais Fowl.** — BRECHEMIN, L., in the *Journal d'Agriculture pratique*, Year LXXXIV, No. 42, pp. 314-315, plate, 1. Paris, October 14, 1920.

This hardy breed, which is well suited to the country, does not thrive in small runs, but does well if it has a fairly extensive range. It made a tentative appearance at poultry-shows previous to the war, but attracted little attention. At the last Show of the Central Society of Aviculture in Paris (held at the Grand Palais), it was awarded the prize of honour.

The Bourbonnais fowl, as met with in very widely separated districts of France, is a white bird with ermine mantle. The Bourbourg race in the North and many of the Gâtinais fowls also have this plumage, but the actual type in question at present is especially common in the valleys of the Allier and the Loire, whence its appellation of Bourbonnais.

The Bourbonnais Club has recently fixed a standard, of which the most characteristic points are given below.

The cock should be strong, but elegant and active, not heavy ; *head* average size ; *beak* strong, white, striped or marked with black ; *eyes* lively, orange-red ; *comb* not over-developed, simple, of fine texture, very straight and detached from the beak, having 5 to 6 very regular and distinct notches ; *ear lobes* medium-sized and red ; *wattles* average, fine in texture ; *neck* is well-proportioned to the back, which is long and broad ; *chest* broad and deep ; *wings* not over-developed, but strong ; *legs* powerful, free from the body ; lower part of leg rather long of pinkish-white colour ; *tail* of average length forming a good continuation of the line of the back ; *toes* 4 in number and *claws* of same colours as beak.

The hen has the same characters as the cock, with the usual sexual differences, i. e., rather smaller size, comb smaller and often hanging down during the laying season.

In both sexes, the *plumage* is entirely white, except the feathers of the mantle, which are barred in the centre ; in the cock, the tail is black, with a white border on the edge of the large and median feathers. The mantle of the hen seems darker, the feathers being striped with black rather than barred ; the tail is black with some white stripes.

1161 – **Feeding Fowls on Groundnut and Palm-Oil Cakes.** — GOUIN, A., in *Journal d'Agriculture pratique*, Year 84, No. 41, pp. 296-298. Paris, October 7, 1920.

For 25 years, the author has been giving his fowls (which he keeps in a pen), cakes with a high nitrogen content, and for the last 4 years, he has fed them exclusively on this fare, consisting of $\frac{1}{3}$ groundnut cake, and $\frac{2}{3}$ palm-oil cake. The birds never get grain of any sort, the only addition ever made to the cakes being a little bone-meal. Each fowl consumes daily just under 100 gm., of the mixture, the daily ration costing 6 centimes. As 25 fowls lay on an average, 10 eggs a day, the net cost of the eggs is 15 centimes each. The quality of the eggs leaves nothing to be desired.

Further, these nitrogenous cakes make the birds grow more quickly than the other, dearer foods usually given to poultry (wheat, buckwheat, rice, bran, potatoes).

Ducks also greedily eat groundnut and palm-oil cakes, and grow very rapidly when fed on them.

1162 – **Extraordinary Early Laying of a Black Bresse Hen.** — *La Revue avicole*, Year XXX, No. 11, p. 6. Paris, November 1, 1920.

M.me M. L. BRUN, member of the Central Avicultural Society of France, mentions a case of extraordinarily early laying on the part of one of her pullets. The bird, which belonged to the black Bressé breed and was hatched on April 12, laid its first egg on July 8, that is to say, when less than 3 months old. This egg weighed 35 gm., and those the bird laid afterwards weighed as much as 37 gm. At the end of October, the fowl had already laid 52 eggs.

1163 – **Experiments in Crossing Pea-Fowl.** — BLAAUW, T. E., in the *Revue d'Histoire naturelle appliquée*, Part. II, *Ornithologie-Aviculture*, No. 2, pp. 46-48. Paris, February, 1920.

After having bred black pea-fowl (*Pavo-cristatus* var. *nigripennis* for twenty years, the author obtained a black and white male. The latter, on being mated with females of the same variety and of the usual colour, produced perfectly white peacocks and pea-hens.

When mated with a white *cristatus* female (from another brood), it produced 2 male and 2 female *cristatus* chicks. These being mated together, their offspring were nearly all ordinary *cristatus* individuals, but there was one normal *nigripennis*.

The hybrids resulting from crossing a Javan male (*P. muticus*) with a *cristatus* pea-hen showed intermediate characters. These hybrids were perfectly fertile when mated together, or with individuals of the original species. The offspring of the hybrids that had been mated together resembled their hybrid parents, and did not revert to either of the two original types.

The mating of one of these hybrid males with a white *nigripennis* female produced :—

(1) A male resembling a male *cristatus* or *nigripennis* with a small zone of brown feathers barred with black on its back similar to that found in the centre on the back of the pure Javan male, or in the young of that species.

(2) A female resembling a *cristatus* female, with the lower part of its body imperfectly pencilled. The yellow skin on the head of the Javan pea-fowl, which persists in the hybrids, had disappeared in the case of the last two birds.

The results of these experiments is, in the author's opinion, that *nigripennis* is a variety of *cristatus* due to melanism about to turn into albinism.

A cross between *cristatus* and *nigripennis* does not give any intermediate forms, but reproduces one or other of the parent forms, as occurs in crossing the white Arctic goose (*Chen hyperboreus*) with the blue species (*Chen coerulescens*).

It is however, curious that the white bird produced by *nigripennis* parents, and the white offspring produced directly by *cristatus* are not the same, judging by their descendants. The white offspring of *nigripennis*, on being crossed with *nigripennis* birds, produces white *nigripennis*, or black and white *nigripennis* individuals (the latter occur rarely). The white offspring of *cristatus*, crossed with *nigripennis* produces *cristatus* birds that, in their turn, produce *cristatus* and *nigripennis* descendants.

As the Javan pea-cock and the *cristatus* (or *nigripennis*) are two very distinct varieties, their products are intermediate, but these varieties must be very nearly related as they mate together and their offspring in all degrees are fertile.

The *muticus* and the *cristatus* (or *nigripennis*), varieties behave like the Golden Pheasant and the Amherst Pheasant.

The following table summarises the crosses made by the author :—

N ♂ . . . / N ♀ . . .	N ♂ ♀	N^P ♂ / N ♂ ♀
N^P ♂ . . . / N ♀ . . .	N^B ♂ ♀	
N^P ♂ . . / C^B ♀ . . .	C ♂ ♀	C / N
S ♂ . . . / C ♀ . . .	H ♂ ♀ hybrids inter-fertile and fertile with 6 and C or N	
H ♂ . . . / N^B ♀ . . .	C, variety without yellow skin present in first cross H	
N^B ♂ . . / N ♀ . .	B + N + N^P	
C^B ♂ . . / N ♀ . . .	C	C / N

ABBREVIATIONS : N = *nigripennis* — C = ordinary (*Cristatus*) — P = black and white — B = White — S = Javan pea fowl — H =hybrids.

1164 – **Cross Between a Peacock and a Fowl.** — TROUESSART, E. (Professeur de Mammalogie et d'Ornithologie au Muséum d' Histoire naturelle, Paris), in the *Revue d'Histoire naturelle appliquée*, Part. II, *Ornithologie-Aviculture*, Nos. 4-5, pp. 100-102. Paris, April-May, 1920.

In 1907, the Author together with M. PAYS-MELLIER, presented to the Académie des Sciences, two birds, the offspring of a cross between a peacock (*P. nigripennis*) and a buff Cochin-China hen (*Pavo cristatus* var. *nigripennis* × *Gallus* var. *sinensis*). They inherited the proportion of the peacock, and like it could fly, whereas the wings of the mother were

quite useless for purposes of flight. Both the hybrids were males, and had well-developed spurs. On the whole they resembled a pea-hen, however, the only character these birds seemed to have inherited from their mother was the number of their tail-feathers, which was 14, as in the hen instead of 18, as in the case of the peacock.

1165 – **Sericulture in France and in the French Colonies** (1). — I. RANC, A., La sériculture française, in *La Nature*, No. 2411, pp. 241-344. Paris, June 19, 1920. — II. IDEM. L'industrie française de la soie et de la sériculture coloniale. *Ibid.*, No. 2422, pp. 155-159 September 4, 1920. SERICULTURE

I — According to the General Report on French Industries drawn up by the Ministry of Industry and Commerce in 1919, the condition of the French trade in silk fabrics, and articles of silk, was as follows:

Normal production	600	million	francs
Total exports	400	»	»
Imports	49	»	»
Home consumption	250	»	»

From 1750 to 1852, silk production in France was continually increasing. Starting from an average annual production of 6 600 000 kg., of cocoons during the period 1750-1780, it rose to 24 000 000 in 1846-1852 and to 26 000 000 in 1853, a date which also coincides with the great development of the spinning industry when the production attained 2 000 000 kg. of raw silk. But with the appearance on the market of Asiatic silk and the breaking out of silk-worm diseases, an irregular, but constant decrease in cocoon production set in, and this reached its lowest in 1876, when only 2 000 000 kg., was produced. A slight increase was observable in 1858-6 the figures rising to 11 000 000 kg., and this favourable turn of affairs continued in 1862-73. The first increase was due to the introduction of silk-worms from Bulgaria, Wallachia, Georgia, Armenia and the Caucasus, and the second was brought about by the practical application of measures for the control of silk-worm disease, which were based on the investigations begun by PASTEUR, in 1855, and coincided with the use of Japanese eggs, these being more resistant to pebrine.

However, although the production of resistant "seed" had developed to a considerable extent, so that in 1900, 30 000 kg., of "seed", worth 6 880 000 francs, was exported, and in spite of the importation of foreign silkworm eggs, the silk industry continued to decline. During the decade 1891-1900, the annual average was 8 458 175 kg., with a maximum of 10 584 491 kg., and a minimum of 6 883 587 kg. From 1900 to 1910, the average sank to 7 million kg., and from 1914 to 1919, the decrease was always noticeable, as is shown by the following Table:—

(1) See: *R.*, Sept. 1912, No. 1330; *R.*, Sept. 1914, No. 839; *R.*, Dec. 1914, No. 1157; *R.*, June, 1918, No. 676; *R.*, Nov. 1918, No. 1264; *R.*, Feb., 1919, No. 234; *R.*, July Sept. 1919, No. 966; *R.*, Oct.-Dec. 1919, No. 1212; *R.*, March, 1920, No. 353. (*Ed.*).

Years	Production in kg.	Value in francs
1914	5 067 000	19 908 000
1916	2 820 000	12 024 000
1918	3 010 000	22 257 000
1919	2 671 000	20 121 000

The value of the cocoons, however, has greatly increased, although there has been a great diminution in the number produced.

During the first half of the nineteenth century, cocoons only fetched from 3 fr. to 4.50 fr. per kg. The scanty supply in 1858 raised the price to 8 fr., and it remained at this level for ten years, to sink again, in recent years, to 4.25 fr., per kg., in 1916, 7.38 fr., in 1918, and 7.53 fr. in 1919.

The decrease in the number of cocoons produced of late years may be attributed to the war, but how can it be explained in times of peace? In 1913, France produced 500 000 kg., of raw silk, and consumed 5 109 000 out of the 7 545 000 kg., imported. The large demand and the small supply should have increased the price of cocoons. The latter, on the contrary, fell, owing to the introduction of Asiatic silk on the market. This Eastern influence was especially manifested by the importation of raw silk produced in the Far East by factories that employed European methods. To such a large extent was this foreign silk used that, whereas in 1875 there were 27 250 reeling basins, in 1888 there were only 10 300. Further, the following figures, giving the amount of cocoons imported, show the decrease in the work:—

Years	Weights of imported cocoons
	kg.
1897	1 201 541
1901	366 582
1905	182 502
1906	685 114

In 1913, the import of cocoons rose to 464 900 kg., supplied by Turkey, Russia, Spain and the French Colonies. If, however, hopes may be entertained that the spinning industry will improve, there is little chance of improvement in sericulture.

The following Table shows that the latter continues to decline.

The high prices (107 to 110 fr.) paid last April at Marseilles for picked cocoons from the East suggest that the industry will recover, for it is anticipated that the native cocoons of next season will fetch 15 to 20 fr., per kg.

It must not be forgotten that sericulture is an industry that is only possible where labour is cheap. For this reason, it ought to form one of the occupations of the colonies, which would send the raw material to Paris.

Years	Number of silk-worm rearers	silk-worm eggs put to incubate (ounces of 25 grammes)
1902	128 000	—
1904	125 244	—
1908	123 804	187 073
1912	99 000	—
1914	83 525	108 943
1916	52 758	61 765
1918	60 057	67 136
1919	52 041	—

II. — The condition of the French silk industry at the present time is characterised by :— (1) The decadence of national sericulture ; this seems irremediable, given the great cost of labour ; (2) the stagnation at the reeling-basins, which threatens to stop the importation of colonial cocoons ; (3) the important position assumed by Japan and the United States on the world's silk markets ; (4) the decrease in raw materials.

The statistics of raw-silk production show how greatly it has increased in the Far East.

Four year averages of raw silk production in kg.

Years	Western Europe	East and central Asia	Far-East	Total
1871–1875	3 676 000	676 000	5 194 000	9 546 000
1876–1880	2 475 000	639 000	5 740 000	8 854 000
1881–1885	3 630 000	700 000	5 108 000	9 438 000
1886–1890	4 340 000	738 000	6 522 000	11 600 000
1891–1895	5 518 000	1 107 000	8 670 000	15 295 000
1896–1900	5 220 000	1 552 000	10 281 000	17 053 000
1901–1905	5 312 000	2 304 000	11 476 000	19 092 000
1906–1910	5 459 000	2 836 000	15 917 000	23 212 000
1911–1914	4 619 000	2 419 000	18 076 000	25 114 000

In 1913, production reached its maximum with 27 320 000 kg., but at once began to decrease, being only 23 665 000 kg., in 1915. The following Table, which gives the production of the various countries for the last 3 years clearly shows the great superiority of Japan.

Buyers in the United States are considerably increasing their purchases on the markets of Japan, Shanghai and Canton, which has the effect of continually raising the prices.

Country	1917 kg.	1918 kg.	1919 kg.
France	205 000	240 000	185 000
Italy	2 820 000	2 695 000	1 185 000
Spain	70 000	75 000	70 000
Austria	85 000	85 000	75 000
Hungary	65 000	65 000	50 000
Europe	**3 245 000**	**3 160 000**	**2 230 000**
East and Central Asia	**1 040 000**	**1 040 000**	**800 000**
China (Shanghai)	4 580 000	4 871 000	3 900 000
China (Canton)	2 345 000	1 650 000	2 300 000
Japan	15 445 000	14 655 000	14 600 000
India	105 000	110 000	100 000
Indo-China	5 000	5 000	5 000
Far East	**22 480 000**	**21 291 000**	**20 905 000**
GENERAL TOTAL	**26 765 000**	**25 431 000**	**23 935 000**

The following statistics show the decrease in the amount of raw silk imported into France from China and Japan from 1913 to 1919 :

	1913	1917	1918	1919
China	3 623 000	2 893 900	1 952 400	2 822 600
Japan	1 577 000	1 444 900	2 145 500	1 081 000

In addition, the amount of silk purchased by America from France in 1918 was reduced by 40 500 000 fr.

Both these facts indicate that France should endeavour to obtain the raw material from her colonies, especially from Morocco and Indo-China.

In Morocco, the silk-industry was in a flourishing condition from the tenth to the thirteenth century, but the competition of European products and silkworm diseases (especially pebrine, which made its appearance in 1850) greatly reduced it. Nevertheless, ten thousand workers are still employed in the industry, which is of considerable importance even now. They are engaged in working up Spanish-Morocco products. The factories use imported raw material ; from 1910 to 1916, the amount of raw silk imported reached 114 600 kg., of which $^4/_5$ came from France.

The propaganda for the encouragement of silkworm rearing dates from

1914, and includes: The distribution ofdifferent varieties of silk-worm eggs; supervising and popularising silkworm breeding; the purchase of the products obtained, and in addition, the plantation of mulberry trees, of which there are large numbers at Meknès and Rabat.

The following Table gives the results obtained for the first 4 years: —

Years	Number of breeders	Quantity of silkworm eggs, in ounces	Weight of cocoons in kg.	Average yield % per ounce	Observations
1914. . . .	—	—	402	—	Trial brood
1915. . . .	12	50	1349	27	—
1916. . . .	38	44	815	18.5	Disease (Pebrine)
1917. . . .	108	51	1149	22.5	Disease (Muscardine, flacherie)

From the experience of these 4 years, it was found that selected; "seed" should always be imported in the autumn; by the use of incubators, the silkworms hatch out quickly, making their appearance in April just when the mulberry leaves began to unfold.

It was also discovered that there was a great lack of hygiene on the part of the natives. Therefore, the best plan is to produce cocoons in Morocco and send the finest to supply the French factories, reserving the remainder for the native industry.

The problem is simplest in Indo-China, where it is not a question of resuscitating a dead industry, but of improving and organising one that already exists. Tonkin, Annam, Cochin-China and Cambodia could supply France with large quantities of raw material, specially Cambodia, where the climate is warm and sufficiently dry, the soil is fertile, and the inhabitants' skill in silkworm-rearing is well-known.

In 1905, the French Administration furnished silkworm eggs selected according to Pasteur's method. At Phu-lang-Thuong, an establishment for the production of eggs was founded and popular leaflets were distributed. The excellent results of this propaganda led to the foundation of new types of silkworm-breeding establishments and the founding of 2 silk-worm egg-supplying centres at Bach-hat and Kienau (Tonkin) which were chiefly engaged in the selection of native breeds while a sericultural research station was added at Phu-lang-Thuong.

Cochin-China, Annam and Cambodia followed the example of Tonkin.

The reeling-basins were also altered in order to obtain silk of a better quality, and steam spinning mills were established. Owing to the private initiative of French companies, the matter has been taken up successfully, with a great advantage to France, as can easily be imagined.

The following data give the exports of silk from Indo-China:

		France	Foreign countries	Total
		Metric tons	Metric tons	Metric tons
1912	Raw silk	16	86	102
	Waste »	83	4	90
	Floss	2	3	2
		101	**93**	**194**
1911	Raw silk	40	59	99
	Waste »	69	—	69
	Floss	2	—	2
		111	**59**	**170**
1913	Raw silk	17	76	93
	Waste »	71	—	71
	Floss	3	—	3
		91	**76**	**167**
1914	Raw silk	11	37	48
	Waste »	42	—	42
	Floss	—	—	—
		53	**37**	**90**
1915	Raw silk	20	35	53
1916	Raw silk	7	25	32

1166 – **The Results of Experiments in Breeding Japanese Bivoltins in Italy.** — CAMPBELL, C., in *Il Coltivatore*, Year LXVI, No. 25, pp. 616-618. Casale Monferrato September 10, 1920.

During the silkworm season of 1919, the author carried out, at Cassino (Province of Caserta), the first experiments with Japanese bivoltins introduced into Italy by the Sericultural Institute of the " R. Scuola Superiore di Agricoltura " at Portici (Naples), using the " Nipponnishiki " breed.

Most of the eggs hatched out quite regularly, but as is characteristic with bivoltin races, some of the eggs did not hatch at all. In the first stages, the larvae proved very strong and moulted at the right times. They differed greatly both in their development and the pigmentation of their skin as well as in the distinctness of the crescent-shaped marks on the 5th and 6th segments, which were scarcely visible in some of the insects, and very clear in others. Further, some of the larvae were more or less gibbous. The latter, which according to QUAJAT, belonged to the Chinese breed " Pai-pi-lung-chiao-tsan ," were isolated, in order to study their offspring.

The pupation of the larvae was not very regular, for after the second moult, there was a certain difference in size between the caterpillars of each

brood. The cocoons also were not very uniform, either in size, or shape; some of them were very much constricted, in others the constriction was scarcely noticeable, while in a certain number, it was entirely absent. Though most of the cocoons were white, others were of a golden yellow of different shades; they also varied in shape; these last were kept apart for isolated breeding.

During the season of 1920, two small rearing experiments were made with the eggs of moths from the gibbous caterpillars and those laid by moths from the yellow cocoon.

Not all the eggs of these two lots hatched out. Sometimes the larva developed completely within the egg, but it never emerged, and why it did not do so, the author is unable to say with any certainty. He reared two lots of the silkworms that did hatch out; they developed quite regularly until pupation, without any visible sign of disease.

In the group of gibbous larvae, this character did not occur in all the individuals, and when present was not always equally distinct. The cocoons of this group were all white and fairly uniform as to shape and size.

The lot of caterpillars from the yellow cocoons all produced yellow cocoons varying in shape and size, like the cocoons from which they originated.

None of the eggs laid by the two groups in 1920 hatched out. They were yellow when laid, but quickly changed to the ashen colour characteristic of annual breeds. The bivoltin character was evidently lost, or was not natural to the isolated forms.

The observation of the Japanese bivoltins reared in the district of Caserta, and especially his investigations on a special brood, enabled the author to state that the character of gibbosity, which is so clear in the last stages, only occurred in a minimum proportion of the larvae, and was little accentuated. There was greater uniformity in the characters of the silk worms than that he had found in the brood reared the preceding year. On the other hand, there were many larvae that moulted 5 times. In the case of these individuals, although they had hatched out at the right time, the moulting periods were so very irregular, that some moths emerged from the cocoons after 40 days, while there were also larvae that had not yet pupated.

The author concludes that it is most inportant to encourage summer breeding as much as possible, but that the scientific and technical side of the question is by no means solved. In the meantime, it is evident that the Japanese bivoltin " Nipponnishiki " breed is not pure, but is the result of many crosses, and it would be useful to know how it has been obtained. The types that have been isolated from it have not the characteristic of bivoltins and the larvae and cocoons are very variable.

1167 – **Bee-Keeping in the Grand Duchy of Luxemburg.** — KUNNEN, N. P. in *L'Apiculteur*, Year LXIV, No. 10, pp. 239-241. Paris, October, 1920. BEE-KEEPING

Bee-keeping was very general in the Grand Duchy of Luxemburg as early as the end of the eighteenth century. In 1775, while the country-

was still under the dominion of Austria, the Empress Maria-Theresa promulgated an edict conferring great liberty and many favours upon bee-keepers. A book on the industry published in 1756, by Joseph COLLIGNON at the "Bible d'Or" in Metz, and written by Abbé PERILLIAT of that town, under the title of "Nouvelle construction de ruches de bois avec la façon d'y gouverner les abeilles, inventée par M. PALTEAU, premier Commis du Bureau des Vivres de la Généralité de Metz" was fairly widely read in the Grand Duchy, as was also a book by M. DUCHET, published at Fribourg in 1771 viz., "Culture des abeilles, ou methodes sur les moyen de tirer meilleur parti des abeilles par une construction de ruches mieux assorties à leur instinct." A pamphlet published in German in 1786, and of which a second revised edition was brought out in 1918 by M. BEFFORT, 3 Place d'armes, Luxemburg, served as a guide to a certain number of bee-keepers of the period who already were using hives with partitions. Bee-keeping was, however, not regarded as a means of gaining a livelihood, but rather as a little subsidiary industry in the hands of the labourer, workman, and small employee.

In Year IX, when the Duchy, as the "Département des Forêts" formed part of France, an official communication recommended bee-keeping in the following terms :— "If the bees were more numerous and better cared for,we should no longer be dependent upon foreign countries for our wax supply the value of which exceeds 30 million fr., per annum." In 1811, the Director General of the Waters and Forests addressed a circular to the officials of his Department. His concluding phrase was :— "I urge you to spread these ideas among your foresters and such of your agents as have facilities for bee-keeping and to assure them that this industry would in no wise interfere with their duties. By so doing, you would further the interests of your subordinates and carry out the wishes of the Government."

Thus, apiculture was already flourishing in the Grand Duchy, where, in 1853, the Abbé Dr. DZIERZON, of Karlsmarkt (Silesia), invented or improved the movable hive-frame in Germany. Very soon, hives with movable frames found their way into the Grand Duchy. In 1862, M. KLEIN, a magistrate at Esch on the Alzette, published a translation of a French hand-book by MENUISIER on the movable system. However, the MENUISIER hive which opened above, like the composite hives in use at the present time, found no partisans.

The Italian bee, which was introduced into Germany by Dr. DZIERSON, was first imported into the Grand Duchy in 1860, by KOLTZ, Inspector of Waters and Forests, and again, in 1864, by BUCH, a schoolmaster at Belvaulx. In the south of the country, there was a certain predilection of the Italian bee, until towards the end of the nineteenth century. In the north, the Carnolian variety was frequently imported. During the last twenty years, the black native bee has been reared by preference.

At the Agricultural and Horticultural Show held at Luxemburg in 1875, on the occasion of the 25th. anniversary of the Lord-Lieutenant-ship of Prince Henry of the Netherlands, two Luxemburg bee-keepers ex-

hibited 2 kinds of hives with movable frames, which were then in use in the country. One of the exhibitors, Abbé SAX, and his friend GRAF, showed a hive of the OETTL horizontal type, the other (the author) showed BERLEPSCH'S vertical type.

The first of these systems is still met with in some of the hives of the country, the second (the STANDER with 3 storeys) has held its own until the present time, and can be found beside others of more recent design.

Since 1875, apiculture has taken a new impetus. A certain number of bee-keepers, who had been on friendly terms since the Exhibition of 1875, joined together in 1876 to found a Cantonal Bee-keeping Association.

Bee-keeping courses have been held since 1883 at the Ettelbruck.-State Agricultural College, these were followed some years later by special bee-keeping courses for schoolmasters, with practical demonstrations at the hive. Finally, in January, 1886, the cantonal Societies founded in the preceding years, united to form a Federation of the Apicultural Societies of the Grand Duchy. The apiculturists who were elected to discharge the duties of President and Secretary in 1896 are still in office. For 34 years, the Federation sent, first every 4 years, and afterwards every 2 years, lecturers to each Cantonal section, It publishes a paper on beekeeping, the *Bienenzeitung* which is sent gratuitously to the members of the Association. This paper relies largely on experiments made in other countries, and reprints from the agricultural review of neighbouring lands, extracts adapted to the requirements of Luxemburg.

Thanks to these efforts, movable frames are now the rule throughout the Grand Duchy, and rational methods are widely practised there. Nevertheless, there are still some 3000 hives constructed on the fixed system among the 13000 hives (in round number now existing in Luxemburg).

The Apiculture of the Grand Duchy has not failed to take part in international organization and has sent exhibits to the various international exhibitions. The Luxemburg Apicultural Federation won the gold medal at the Paris World Exhibition in 1889 for its model hive, and in 1900, its collection of honey from the different States of Luxemburg was awarded the first prize. At the World Exhibition at Antwerp in 1894, and at Brussels in 1897, the Luxemburg apicultural products enjoyed well-earned success.

At the 4 first International Apicultural Congresses (at Paris, Brussels, and at Bois-le-Duc (Holland), in which France, Belgium, Holland, Italy, Russia, Austria, the United States, and Luxemburg took part, the Federation of the Apicultural Societies of Luxemburg was represented by M. Ed. HEMMER and by the author, both members of the Permanent Committee of the International Congresses of Apiculture. At the festivities held at Paris in 1906 on the occasion of the fiftieth anniversary of of the central Society of Agriculture, the Secretary General of the Grand-Ducal Federation conveyed the congratulations and good wishes of the Luxemburg bee-keepers (see the *Apiculteur*, Paris, 1906, Year 5, pp. 168-169). Two Luxemburg bee-keepers sent reports to the 5th International Congress which was held at Turin. Being unable to attend personally

they entrusted the reading of their reports to their representatives MM. Tombu de Huy änd Menden of Cologne. The Vice President and the Secretary General of the Grand-Ducal Federation have, since 1889, attended the important Congresses known as the "Wanderversammlungen der deutschen, osterreichischen, und ungarischen Bienen-zuchter." Luxemburg apiculture has thus not held itself aloof, but has taken a large part in international life.

Nevertheless, according to the author, the Grand Duchy is still far from having reached the height of its prosperity. He, however, mentions with great satisfaction, that the Luxemburg clergy and especially the schoolmasters, are devoting themselves with much zeal to the promotion of intensified methods of apiculture.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

1168 – **Power Farming in Spain.** — I. Concurso de tractores en Sevilla, in *Boletín de agricultura técnica y económica*, Year XII, No. 139, pp. 513-515. Madrid, July 31, 1920. — II. Concurso de aparatos para el cultivo mecánico de las tierras. *Idem*, No. 141, pp. 712-715, Sept. 30, 1920. — III. Passelègue, G. La culture mecanique en Espagne, in the *Journal d'Agriculture pratique*, Year LXXXIV, No. 42 pp. 312-314. Paris, Oct. 14, 1912.

Following upon a meeting of the Spanish Agricultural Association held in Madrid on November 25, 1916, and also in consequence of reports presented by M. Fernandez Cortès and by C. Resines Secretary of the Spanish Royal Automobile Club, a petition was presented to the Government and Parliament requesting that the customs duty on petrol should be lowered to enable mechanical farming to become economically possible and that the State should give financial and technical help to the Association in all attempts initiated or supported by it with the object of popularising power farming.

A Royal Decree dated November 30, 1919, reduced from February 1, 1920, the customs dues from 30 pesetas to 10 pesetas (1 peseta = 9½d. at par) per 100 kg. In addition an extra Government grant was given to the Machinery Experimental Station at Madrid and to the agricultural schools to enable them to study and popularise mechanical cultivation.

Power farming trials were held near Seville from May 1 to 15, 1920, under the auspices of the Seville Chamber of Agriculture, on the initiative of their President Don José Huesca y Rubio. The technical arrangements were in the hands of Don Mariano Fernandez Cortès, Director of the Machinery Experimental Station attached to the Royal Agricultural Institute at Madrid.

These were the first official trials to be held in Spain.

The sixteen machines that took part, originated as follows:—

1 British, 3 French, 8 American, 1 Italian, and 3 German.

Tractors with 2 driving wheels: — 18 HP. Chapron; 25 HP. Saunderson; 18, 25 and 40 HP. Case; 20 and 30 HP. Titan; 25 HP. Parret; 25 HP. Fiat; 30 HP. Lanz; 25 HP. Hansa Lloyd.

Caterpillar tractors : — 20 HP. CLEVELAND.
Motor ploughs : — 80 H. P. W. D.
Are carriage tractors : — 18 HP. MOLINE.
Rotary cultivators : — 5 and 35 H. P. S. O. M. O. A.

The trials include the cultivation of fields and olive groves. In the former, each machine had to plough at a depth of 18 to 25 cm., a plot of about 2 hectares using petrol as fuel ; and in the latter, spring ploughing had to be done at a depth of 12 to 15 cm.

The land chosen for large-scale ploughing was a very strong alluvial deposit, which had been a pasture for some 40 years and was full of thistle and couch-grass, whilst horse teams and pedestrians had beaten out paths in every direction. The work practically amounted to breaking up, and further, there was risk of obtaining bad results, particularly too heavy a consumption of petrol.

The ground chosen for cultivating olives was more normal and rain had left it in excellent condition for ploughing. The following table gives the most interesting results :—

Test results of mechanical cultivation of an olive grove.

Machine	H. P.	Plough	Average Depth	Petrol consumption	
				per hour	per hect.
			cm.	litres	litres
Cleveland	20	10″ 2 furrow Olive	13.81	7.97	24.07
Moline	18	10″ 2 furrow Moline	11.80	6.21	19.22
Somua	35	Rotary cultivator	11.83	11.65	25.61
Somua	5		10.34	5.07	57.60

According to G. GUILLEMÉ BRULON (1), an agricultural engineer, mechanical cultivation is bound to develop considerably in Spain. The lack and irregularity of the rainfall often causes great scarcity of fodder and pasturage, and the maintenance of draught animals is very difficult. In addition, the shortness of the rainy season gives very little time favourable for ploughing. In nearly all Spain and Andalusia the rotation practised is " el tercio, " that is to say the soil is cultivated once in three years, the rotation being : — 1st year cereal ; 2nd year pasture ; and 3rd year fallow. An Andalusian agriculturistst Sanchez de IBARGÜEN who has a farm at Moron de la Frontera (Seville) has showing that with the use of mechanical cultivation results can be obtained that would not be economically possible with teams ; using a motor he has been able to work the soil in August and to replace the fallow in the rotation ly ,a leguminous crop. In a book entitled *Agricultura Moderna*, Audié GARIDO states that SANCHEZ DE IBARGÜEN now feeds 546 kg., live weight of cattle

(1) See G. G. BRULON, La culture mecanique en Espagne, in *La vie agricole et rurale* Year IX, Vol. XVII No. 46 pp. 302-304. Paris, Nov. 13, 1920, (*Ed,*.)

per hectare ploughed instead of 40 kg. by ordinary means. His harvest averages 18 quintals of wheat per hectare, whereas according to the most recent statistics the average for this region is barely 10 quintals per hectare.

Another exhibition of power-farming machinery organized by the "Consejo de Fomento" with the co-operation of the Provincial Deputation, the "Ayuntamiento" and the scientific economic and agricultural institutions of Saragossa was held in that town from Sept. 25 to Oct. 10 and was followed by an exhibition of agricultural machinery from Oct. 12 to 20, 1920.

It will thus be seen that Spain is striving to extend the use of mechanical cultivation.

1169 – **A Tractor with the Greatest Possible Grip.** — DESSAISAIX R. in the *Journal d'Agriculture pratique*, Year 84, No. 41, pp. 1-300, figs. 1 Paris, Oct. 1920.

In order to obtain the greatest possible effort of traction from a tractor, it has been attempted to make all the wheels propulsive. For several years tractors of this kind have been suggested in Great Britain, France, America, and Italy.

A new model, the VALERE CHOCHOD, was shown during the Semaine d'Automne de Chartres, by the CARTOUCHERIE FRANÇAISE DE SURVILLIERS (Seine et-Oise). The 4 cylinder engine, running on oil 90 mm., in bore and 150 mm., stroke, develops 20 to 24 HP. at 1,100 revs. per min. A pulley below the radiator provides a belt drive for other machinery.

The four driving wheels are 40 inches in diameter, the tyres, 1 inch thick, are fitted with grips and the two wheels on each side are actuated by an enclosed chain drive.

Through the gear box the engine drives shafts which can be geared up to each wheel separately, each wheel actuating. through a chain, the corresponding wheel running loose on the other axle. Thus the two wheels correspond to the chain-tracks of a caterpillar tractor. Steering and turning is done though levers which brake the wheels on one side while the other turns. The weight of the tractor is about 2 ½ metric tons, the maximum and draw-bar pull is 1300 kg.; the ratio of these two figures gives a coefficient of 0.52.

The tractor is provided with two driving seats facing each other, so that there is no need to turn the machine round at the end of each furrow. The two speeds are 3500 and 4500 metres per hour and there is a reverse.

The track is 1.25 m. × 1.75 m. overall length, 2.98 m. breadth 1.87 m., height 1.85 m., the ground clearance being 30 cm.

1170 – **The A. R. A. Vineyard tractor.** — FERROUILLAT P. in *Le Progrès agricole et viticole*, Year XLI, No. 43, pp. 394-397, figs. 3 Villefranche (Rhône), Oct. 24, 1920.

The problem of the mechanical cultivation of vines planted at intervals of 1.5 metres as is the case with most of the vineyards of southern France and Algeria, has according, to the author, not yet been satisfactorily solved. A motor is required that is powerful enough to work the whole width between each row in a single journey, narrow enough to travel

without touching the vines and able to turn in a very small radius ; such a motor, must have a narrow, short frame..

Until now the tractors shown at trials are either too weak to draw an implement for earthing-up etc., at a depth of 10 to 12 cm., and cover whole width between the vines, or powerful tractors whose width constitutes a danger to the vines and, moreover, only suit vines planted 1.8 to 2 metres apart.

The new A. R. A. tractor for road and field work is made under the patents of A. DE VIREL and M. E. CAHEN at the DELAUNAY WORKS, Belleville.

It has a patented pliable chain track mounted on four bogeys, its overall length is 2.25 m., breadth 0.70 m., and height 1.50 m., The centre of gravity has been placed as low as possible, 50 cm. from the ground.

Without risk of overturning, the tractor thus can work across ground at a slope of 35° (7 in 10), and is thus excellent for hillside vineyards. The 4-cylinder (70 × 130 mm.) engine runs on paraffin, developing 21 H.P. at 1500 revs per min, 25 H.P. at 1800 revs. per min., and 30 H.P. at 2000 revs. Ignition is by high-tension magneto, there is pressure-fed oiling and thermosiphon water-cooling through a fan and a CHARDARD radiator which has movable parts, and is easy to repair. A metal plate clutch is provided.

The two speeds give 2.5 and 3.6 km., per hour and there is a reverse. The weight is about 1 ½ tons, giving a pressure about 5.7 lb., per sq m. of bearing surface of the track. On the starting handle axle is a driving pulley about 12 in., in diameter by 6 in., broad geared at the ratio of 1 : 2 to the engine. By this means threshers, forage presses, pumps, trussing machines etc., may be driven. As the pulley is keyed to the axle the transmission belt easily keeps taut, the tracks being sufficient anchorage. During ordinary work the pulley is out of gear. A small windlass is also mounted on the tractor for lifting up the implement hauled. The plough made by GUICHARD, at Lieusaint (Seine-et-Marne), can be used either. for earthing-up or uncovering. On a triangular frame, carried on 3 wheels, are 4 plough-bodies, two turning to the right and two to the left, and behind a small double drill plough. These five cover the whole space between the lines. The height of the wheels can be regulated to increase or decrease the ground clearance, and the depth of ploughing. The frame can also be extended to carry plough bodies (one being a drill plough) for use when the inter-lines are 1.50 m., wide. For uncovering, the frame is turned round, with the apex of the triangle in front and the plough bodies are reversed as regards direction and side. The shares are lozenge-shaped and are tightly held by grooves in the frame. The plough is attached to the tractor by a ring or some other pliable coupling. At the back of the plough is the lifting cable which passes over two pulleys on two iron bars fixed on the back of the tractor behind the driver's seat and thence to the windlass.

The plough lifts almost vertically and the tractor can turn within a headland 3 metres wide at the most. The plough can be replaced by

other agricultural implements such as hoe tines, vibrators, etc. About 3 3/4 hours are necessary to plough one hectare.

1171 – **The Dubois Polyculteur.** — DESSAISAIX in the *Journal d'Agriculture pratique*, Year VI, No. 47, pp. 414-415, figs 1. Paris, Nov. 18, 1920.

The tillage machine known as the " Polyculteur Dubois " (29, rue de l'Avenir, Asnières, Seine,) and which was shown at the " Semaine de Motoculture de Chartres ", is driven by a 20 H. P. engine and weighs about 2 metric tons.

The machine is a motor-plough rather than a tractor. The two driving wheels have separate clutches and steering is effected by disengaging one or the other. The back of the chassis receives the front portion of a double-brabant 3-furrow plough fitted with the ordinary lock. Underneath and in front of the chassis, at a certain height from the ground is a loose wheel, placed horizontally, on which the machine only leans when turning.

The method of turning is as follows: — On reaching the end of the furrow, the plough is unlocked by pressing a pedal. The tractor is stopped, and backed, tipping round the axle of the driving wheels and pressing on the loose wheel in front; the ploughs are then disengaged and lifted up. The land wheel is locked and the whole outfit turns on it. The friction of the mouldboards ensures that the ploughbeam will swing over in the transverse plane until the locking pin engages again and the tractor is ready for the next journey.

The head of the plough-beam, which takes all the pull and supports most of the weight of the double-brabant whilst turning, can be regulated vertically according to the depth of ploughing desired. The Polyculteur can be used for hauling other farm implements as well as a cart.

1172 – **Method for Sealing Bottles Hermetically with Unground Glass Stoppers.** — CUSMANO, G. in *L'Italia vinicola ed agraria*, Year X, No. 40, pp. 458-459, figs 4. Casale Monferrato, Oct 3, 1920.

The author has thought out a new method of hermetically sealing, of which the consistent parts are: —

(*a*) A glass stopper with a hemispherical head having 8 grooves.

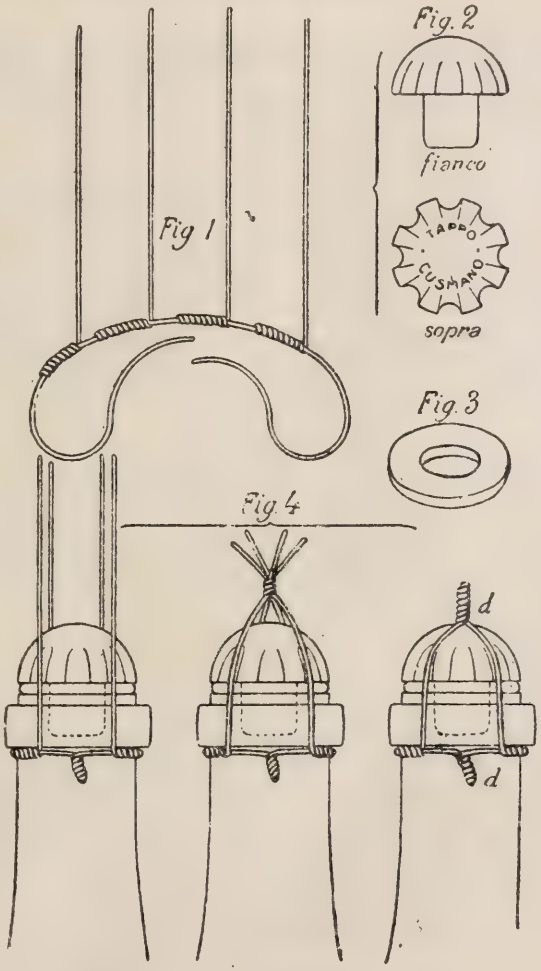
(*b*) A flat rubber ring previously dipped in paraffin wax. This ring can be used continuously, all that is necessary being to wash the ring in water and potash and re-dip it in wax.

(*c*) A length of galvanised iron wire, having 3,4 or 5 lengths of thinner wire wound on it, and sticking out at right angles for about 4 inches.

The stem of the stopper (fig. 2) is passed through the rubber ring and placed in the mouth of the bottle (fig. 3), the iron wire is bent round the lip, secured, then the lengths of thinner wire are passed over the grooves of the stopper and securely twisted; the bottle is thus hermetically sealed The following illustration shows clearly the method.

To open the bottle, any of the binding wires are cut. As a guarantee of the contents of the bottle, a lead wafer can be fixed to the twisted ends of the wires, marked *d* in fig 4.

Another apparatus invented by the author is an "otturatore rapido" a rapid corking machine, which will cork bottles in twenties up to one hundred One man can deal with 1000 per hour.



Method of hermetically sealing bottles with unground glass stoppers.

RURAL ECONOMICS

1173 – **Cost of Pineapple Cultivation in Cuba.** — See No. 1119 of this *Review*.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1174 - **Method of Determining Chlorine Content in Sugar Cane Juice.** — See No. 1112 of this *Review*.

1175 - **Threshing and Husking of Rice in Rhodesia.** — See No. 1093, of this *Review*.

1176 - **The Rancidity of Philippine Coconut Oil.** — PERKINS, GRANVILLE A. (Chemist, Bureau of Science), in *The Philippine Journal of Science*, Vol. XV, No. 5, pp. 463-474 tables 3. Manila, November, 1910.

The purposes of this article are to present evidence as to the relative effect of various factors in the development of rancidity in edible coconut oil, and to point out wherein this evidence leads to a confirmation, modification, or extension of the former conceptions of rancidity. The rancidity factors and their relative effect were: Initial acidity, air, light, moisture, enzymes and non-fatty material, i. e. the substances, largely protein and carbohydrate, that, together with moisture, give the cloudy appearance to freshly expressed oil and which are removed by filtration using trough fuller's earth.

Two year storage tests were made on thirty samples of edible coconut oil, prepared by PARKER H. O. of the Bureau of Science. The results were in general agreement with the accepted views of rancidity and its causes. The action of light was found to be a powerful, but not necessary factor in the production of rancidity. Enzymes from the fresh coconut meat had some effect on the keeping qualities of the oil, but sterilisation was of doubtful benefit.

An oil of low initial acidity remained sweet during two years exposure to air and light.

The author outlines the conclusions formed by previous experimentors, and submits the following conclusions as a result of the above mentioned experiment: — In the type of rancidity of coconut oil studied the first stage is a hydrolysis, the rapidity of which varies with the initial acidity, and the amount of moisture present. Exclusive of any mould action, this hydrolysis may be somewhat accelerated by the action of air, light and a fat soluble enzyme. The second stage is an oxidation of the free fatty acids. Possibly this involves also the oxidation of unhydrolised olein, but the amount of oxidation is dependent on the amount of hydrolysis.

Oxidation is hastened by light and moisture, but light is not a necessary condition.

Though this appears to be the common type of rancidity in coconut oil, the possibility of others is not excluded. Previous tests with peculiar types indicate that a single chemical test is not sufficient to enable a distinction to be made between edible and non edible oils.

For the ordinary types, it appears that the decrease in iodine value, the fuchsine aldehyde test, and the oxidisability number give good indi-

cations of the amount of deterioration. The iodine number alone without some data on the original number has no value. The acidity is a measure of the first stage in the rancidity process.

1177 - **Oil from Tobacco Seed.** — See No. 1107 of this *Review*.

1178 - **Experiments on the Biological Control of Concentrated Extracts of Tomato by the American Method. Proposed New Method of Control and Observations on the Mycological and Bacteriological Content of these Extracts** (1). — BERTARELLI, F. and MARCHELLI, M. (Istituto d'Igiene, University of Parma), in the *Annali d'Igiene*, Year XXX, No. 6, pp. 309-322, bibliogr. of 8 publications. Rome, June 9, 1920.

The HOWARD method for controlling tomato extracts consists in:— (1) Counting the moulds, and determination of a degree tolerance based on a certain % of optical fields containing hyphae; (2) counting the hyphae and spores, according to a conventional cubic unit of measure; (3) counting the Bacteriaceae directly under an average magnification without staining, but with fixed limits of tolerance and in such a way as to avoid counting cocci, which are less easy to distinguish.

When counting, magnifications of 90, 180 and 500 diameters are used, and in measuring, the THOMA-ZEISS cell is used to count the red globules. The various concentrations of the extract are not taken into account. As regards the moulds, a good concentrated extract should not contain more than about 150 hyphae per cc.: the spores and the ferments should not exceed 25 per $^1/_{60}$ cub. mm., and the bacteria should not exceed 100 millions per cc. As the Italians protested, the United States Government is reported to have extended these limits to: 250 spores or ferments per $\frac{1}{60}$ cub. mm., 100 million bacteria per cc., and 66 % of the optical fields with moulds.

G. ROSSI remarks that the method is not logical if the characteristics of the tomato and its derivatives are considered, and that the sole guide is constituted by the organoleptic characteristics. He draws attention also to the fact that in the first place the technical proceedings are too inexact. One of the authors, and also ROVESTI and PEASE express similar opinions as regards the technique. CH. VINCENT has modified the method by replacing counting in the THOMA-ZEISS cell by counts effected in preparations fixed and stained on glass. After having diluted the liquid with 2 parts of sterilised water, 1 cc. of the material is placed on a sheet of glass 1 cc., in size; this is left to dry, then fixed in alcohol, stained with LOEFFLER methylene blue and examined with an oil-immersion objective.

The germs in fields of 0.205 mm. diameter are counted; the average is of the total found multiplied by 300 000, which gives the number of germs per cc.

The authors attempted to ascertain:— (1) If the HOWARD method, modified according to VINCENT, is worthy of adoption; (2) if the concen-

(1) See *R.* Jan. 1912, No. 216; June, 1917, No. 674; May 1919, No. 650. (*Ed.*)

tration of the product has an influence on the microfloral content, and, in consequence, if the limits of tolerance as regards moulds and bacteria should be modified each time ; (3) if the test deserves to be modified and rendered more accurate and simple ; (4) if the cultural tests, really offer possibilities of judgment different from those afforded by a simple optical examination, and, in any case, if the number of active bacteria is low or negligible in comparison with that of inactive bacteria ; (5) if being given the actual nature of the Italian concentrates, there is reason to fear a considerable increase in the number of bacteria during transport over a long distance ; (6) if, consequently, the practical corollary would ensue that indicates the necessity of sterilising the concentrate destined for the United States, by employing practical methods, with which there is the least possible alteration in the organoleptic qualities of the extract, especially as regards colour and perfume.

As regards the enumeration of the moulds, the authors consider that it is not advisable to treat materials naturally poor in extracts in the same way as others which are richer ; also, that despite the care utilised in the preparations, these remain with much the same density as in the THOMA-ZEISS cell. In respect of many points, well defined and clear vision is a difficult matter ; and it is still more difficult to estimate the moulds, which sometimes show only a thread of hypha in the field of vision and at others a felted mass of mycelium.

The counting of the spores and ferments is still less accurate ; they are almost impossible to discern, and identification is uncertain, admitting infinite personal errors. The authors consider, therefore, that it is wiser to omit enumeration, being completely of negative importance, since the hyphae and bacteria are already counted, and the method is full of errors of unlimited magnitude. It is not easy to understand why the estimation of the spores belonging to the hyphomycetes can have any particular value ; the invasion is more logically applied to the number of hyphae than that of the detached spores, and the Blastomycetes always represent, in ordinary pratice, a modest figure that is negligible in comparison with the Bacteriaceae.

As regards the examination of the bacteria, the authors' criticisms are directed towards the fact that no account is taken of the active and inactive bacteria, and that the bacterial content is not estimated in relation to the true residue of the liquid. What is more, in the enumerations that are made, it may be noted that even in the same preparation, the modifications of the figures are considerable and these increase still more when large fragments are present in the field which hide some of the bacteria ; this last drawback is also present in the VINCENT method, which, although it has its advantages, presents nevertheless the disadvantage of having too much density and possibilities of notable personal errors.

The method adopted by the authors may be summarised as follow : — 2 cc. of concentrated extract taken from the tin are put into a test-tube and shaken down by tapping the base gently with a spatula. The content is poured into a glass (after washing with distilled water that is reckoned in

the mass), and still further distilled water added to make up a total of 50 cc. After mixing well, the whole is filtered through a quadruple filter of gauze, carefully washing the precipitate with another 50 cc. of distilled water. The filtrate contains practically all the bacteria in the material and repeated tests have shown that not more than 16 to 20 % of the total bacteria remain on the filter or attached to the glass. A small amount of the of filtrate is removed by means of a pipette graduated to $^1/_{200}$ cc., and $^1/_{200}$ cc. of filtrate is spread over glass slides (washed with alcohol and ether), by holding horizontally; alcohol-ether is used as a fixative and the material is stained with LOEFFLER'S methylene blue.

Counting can be done with the help of an oil-immersion; the authors employed a KORISTKA No. 7 objective with ocular No. 7 fitted with a small glass disc similar to an ocular micrometer with a scale of 1 sq. cm., divided into 100 small squares.

An examination of the data presented shows that the concentrated extracts from Parma correspond as a whole to the requirements of the North-American legislation. There exist, however, in the various types, notable differences as regards the microbial purity and the presence of moulds and ferments. By fixing the limits of tolerance, it should be made clear that the figures fixed by the American regulation apply only to simple concentrated extracts, not exceeding 20 to 22 % of residue, and that, for double and triple concentrated extracts the figures should be increased by at least $^1/_5$ or $^1/_4$, especially as regards the mould content, owing to the fact the maximum oscillations noticeable in the products from the microbial point of view chiefly concern the moulds.

The authors, however, put this questions: — Being given that complete sterilisaton is not possible without changing the organoleptic qualities of the product, is it possible for the living bacteria which remain to multiply in such a way as to make the product inacceptable in America? They therefore proceded to ascertain the number of living bacteria; they perforated the tin with a red hot iron and took samples at various points with a FRAENKEL spoon; the surface was levelled with a sterilised spatula end, the spoon was placed in a small glass dish previously tared while containing an empty spoon. On weighing, the exact weight of the sample would be ascertained. The full spoon was placed in a test tube with 2 cc., of broth and small sterilised glass balls. This was well shaken, rendered uniform, 0.01 cc., was extracted and placed in a second tube containing 9 cc. of broth. After well shaking, another 0.01 cc., was extracted from this second tube and placed in a third tube containing 1.9. cc., of sterilised broth. Samples were then taken from the last-mentioned tube for gelatin plates, from which readings were taken after 10 to 20 days. The removal of samples was repeated, and the examination was completed by counting the moulds. In addition, the tins were kept for 12 to 19 days at a temperature of 37°C., in order to ascertain whether a considerable increase in the number of Bacteriaceae is possible during transport over a long distance.

The authors present a Table showing the results obtained, from which the following points of practical interest have been deduced: —

The active bacteria exist in insignificant numbers compared with the total living and dead Bacteriaceae counted by means of the readings taken under the direct optical examination.

Even after about 3 weeks at 37° C., the number of active bacteria increase but slightly (maximum ratio 1 to 1.5), and in such a way as to be of no value as regards the limits of tolerance. The increase is only marked in the case of moulds, and the danger as regards these should be considered more serious than in the case of Bacteriaceae. In no case, however, was the preliminary conclusions drawn altered, at least as regards the samples examined by the authors. It would be advisable, however, to employ very clean tomatoes especially for goods intended for export. In addition, as there are no reasons that require the radical sterilisation of a product which will keep in practically the same condition for several months, it is useless to insist upon still more rigorous measures.

1179 - **Industrial By-Products obtained from Pineapples in Cuba.** — See No. 1119 of this *Review*.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1180 - **Sausage Yeasts.** — CESARI, E. and GUILLERMOND, A., in the *Annales de l'Institut Pasteur*, Vol. XXXIV, No. 4, pp. 220-247, figs 4. Paris, April, 1920.

All the yeasts isolated from sausages by the authors belonged to the genus *Debaryomyces*, but together with yeasts of this type, salted and pickled meat were found to contain yeasts which could not be made to produce spores. It is very probable, according to the authors, that a systematic investigation of all the yeasts used in salted meats would reveal further new species (1).

1181 - **The Patting of Honey.** — *L'Indépendant de Seine-et-Oise*, quoted in *L'Apiculteur*, Year LXIV, No. 9, pp. 220-221. Paris, Sept., 1920.

Freshly extracted honey is transparent and liquid, then it becomes opalescent, opaque, very hard, i. e. granulated.

Before potting, the impurities should be allowed to rise and then skimmed off. Bad tasting and fermented honey are treated thus :— Boil for 2 minutes in a copper vessel 3 kg., of honey, 850 gm., of water, 75 gm., of chalk ; then add 150 gm., of washed and dried powdered carbon and boil for another 2 minutes. Add 3 whites of egg beaten in 90 gm., of water. and boil for another 2 minutes. Leave to cool and then filter. The honey may also be melted over a water-bath and a red hot iron plunged into it ; then pot as a preserve.

Scum on the honey indicates that it is obtained from sainfoin and is of good quality. If liquid honey is preferred, it can be liquefied in the following way :— Heat over a water-bath until nearly completely melted without boiling or stirring, and allow to cool slowly ; or pasteurise the honey at 90° C. for 15 minutes, but for a longer time at 50 to 55° C, is preferable ; or heat over a water-bath at 77° to 83° C., and draw off into pots while hot.

(1) M. CESARI attributes to the yeast, described in the above note, a part in the ripening of the sausage. See *R.*, Oct.-Dec., 1919, No. 1254. (*Ed.*)

Granulated honey becomes very hard and can be made into briquettes squares, and cubes, which should be wrapped in waxed paper.

1182 - **Grape Storage Tests.** — BONHAM, C. N., in *The Agricultural Gazette of Canada*, Vol. Vol. 7, No. 6, pp. 476-478. Ottawa, June, 1920.

AGRICULTURAL PRODUCTS; PRESERVING, PACKING, TRANSPORT, TRADE

Commercial grape storage tests were started at the Grimsby Precooling and Experimental Fruit Storage Warehouse during the grape picking season of 1919, in order to determine the varieties most suitable for storage for the Christmas market, and the general commercial value therefrom. The 5 varieties included were Niagara, Agawam, Lindley, Vergennes and Black Rogers. The following types of package were employed : 1) Six quart climax basket packed as for immediate shipment : storage temperature 32°F. Removal of all crushed or spoiled grapes was the only special preparation. This method cannot be recommended for long time storage owing to consequent stem mould damage ; 2) keg similar to that in which foreign grapes are imported. Layers of granulated cork intermixed between the berries. The condition of the fruit was practically the same on removal as when put in storage. For small lots this method is preferable to any other but is not economical on a large scale; 3) storage " flats, " i. e. shallow trays 18 × 24 in., and 4 in., deep, with spaces for ventilation ; found decidedly suitable for long time storage of the varieties tested ; Niagara proved worthless for commercial purposes owing to the persistant falling off of berries. Taking all the others into consideration the loss from stem mould was small enough to be overiooked as a cause of serious waste except in a very late season when the grapes have to be picked before they can be properly matured. The Agawam var. was slightly more susceptible than the rest, and the Lindley vars. were almost immune.

General results indicate that if the fruit is stored and packed correctly, a market may be developed which will enable the Canadian grower to dispose of a considerable quantity of grapes on the Christmas market at a satisfactory margin over the prices received at picking time.

DISEASES OF PLANTS

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

RESISTANT PLANTS

1183 – **"Vuiteboeuf" Swiss Jura Wheat Very Resistant to Lodging and Disease.** — See No. 1090 of this *Review*.

1184 – **Varieties of Tobacco Resistant to *Phytophthora Nicotianae*, in the Dutch East Indies.** — See No. 1085 of this *Review*.

1185 – **Direct Hybrid Bearers Resistant to Disease in the Province of Vicenza, Italy.** — See No. 1127 of this *Review*.

MEANS OF PREVENTION AND CONTROL

1186 - **Destruction of Zoospores of Plant Disease Organism by Natural Enemies.** — Harvey R. B., in *Science*, New Series, Vol. LII, No. 1334, pp. 84 Lancaster, Pa, July 23, 1920.

In making some motion-picture photomicrographs of the liberation of zoospores from the sporangia of *Physoderma Zeae-Maydis* (1), the author observed that the zoospores had been destroyed by certain animalcules which are commonly found in decaying vegetable material. No reference has ever been made regarding the importance of these natural enemies of plant diseases which are disseminated by zoospores.

The number of zoospores swallowed by one rotifer (*Proales* sp.) is remarkable. When the animalcules are abundant, the zoospores disappear rapidly. One infusorian (*Keronia* sp.) was observed to devour a perfect stream of the zoospores, at the same time increasing in size until it became almost unrecognisable.

In active cultures, a field may be seen by means of the microsope filled with millions of zoospores swimming about. In a few hours, large numbers of these have been devoured by the animalcules, which rapidly increase in numbers. A few hours later the same protoplasm constituents are seen swimming about not as zoospores but as animalcules. The process of change is so rapid that it raises the question as to whether there is always a cleavage of the proteins and a re-synthesis, or whether there may not be some quicker method of assimilation especially in the unicellular organism in which the cytoplasms of the infusorian and the zoospore ingested are in such intimate contact.

Starting with dry material collected from maize stalks infested with

(1) See *R.* Oct.-Dec.-1919, No. 1269. (*Ed.*)

Physoderma, the animalcules appear first and are present for each batch of zoospores.

It would be interesting to determine just how important these animalcules are as natural enemies of the plant disease which are disseminated by zoospores. Also it would be desirable to collect data to determine if the destruction of the soil microfauna by excessive liming may not be correlated with certain epidemics.

1187 - **Control of Gummosis and Root Rot of Citrus Trees in Sicily.** — See *R.* No. 1121 of this *Review*.

1188 - ***Claviceps Paspali*, Hypocraceae Parasitic on Ergotised Paspalum, in South Africa.** — See No. 1134 of this *Review*.

1189 - ***Diplodia* sp., Spheropsideae Parasitic on Leguminous Forage Plant *Desmodium leiocarpum*, in Cuba.** — See No. 1097 of this *Review*.

1190 - **Diseases and Pests of the Cocoa Plant in Gold Coast., Africa.** — See No. 1114 of this *Review*.

1191 - ***Phytophthora erythroseptica*, a Peronosporaceae Injurious to Belladonna (*Atropa Belladonna*) in Holland.** — WESTERDIJK, J. and VAN LUIJK, A., in the *Mededeelingen uit het Phytopathologisch Laboratorium "Willie Commelin Scholten,"* Amsterdam, IV, pp. 31-32, figs. Amsterdam, 1920.

Phytophthora erythroseptica Pethybridge, already described as a parasite of potato tubers (1), was found by the authors during the summer of 1918, to be the cause of root-rot in one of the Solanaceae, *Atropa Belladonna*. The host-plants examined were suffering from a typical form of wilt due to the fact that the roots and lower part of the stem had been attacked by the fungus. A brown discoloration extended downwards from the collar, by way of the fascicular bundles of the root. The lower part of the fascicular bundles of the stem were also brown and occasionally even the surrounding parenchymatous tissues.

In the discoloured fascicular bundles, the authors discovered a phycomycete which was easily cultivated on artificial media. These cultures soon produced characteristic fructifications which proved the parasite of the belladonna to be identical with *Phyt. erythroseptica*.

Potato tubers inoculated with pure cultures of the fungus isolated from belladonna and from the potato, showed the characteristic reddening of the pulp, which gave place to a blackish-brown after two days. The authors were unable to make infection experiments on the root of belladonna, but they consider it certain that *Phyt. erythroseptica* is the cause of a form of root-rot affecting *Atropa Belladonna*.

1192 - ***Macrosporium Solani*' Hyphomycete Injurious to Tomato in Delaware.** — ROSENBAUM, T., in *Phytopathology*, Vol. X. No. 9, pp. 415-422, figs. 4. Baltimore M. D., Sept. 1920.

Numerous specimens of tomato plants were received in June and July, 1919, from Delaware, showing a disease, the symptoms of which differed markedly from those of any known disease of tomatoes.

(1) See *R.* Sept. 1919, No. 1105. (*Ed.*)

The stems, at the point where they emerge from the ground first turns dark brown. This brown rot or canker penetrates deeply into the tissues and extends above and below the surface soil. With age, the infected portion of the stem becomes even darker in colour, the tissues shrivel up and may break, and the stem falls over at the original point of infection. Occasionally similar brown to black spots are found on other parts of the stem above ground. In such cases, it often spreads a considerable distance from the point of infection and in many cases the rot at the base of the plants produces a girdling effect. If this occurs when the tomato plants are still young, they throw out new roots above this point. In addition to these effects, the plants show varying degrees of wilting and discoloration of the leaves. The disease has been found on tomato plants of all ages, both in the seed bed and in the field. The symptoms mentioned suggested the possible designation of this disease as "foot rot."

This disease was found doing considerable damage in Delaware.

A microscopic examination of diseased stems showed fungus mycelium within the affected tissues.

Numerous isolations from infected plants and from artificial inoculations in the field and greenhouse, establish the fact that a fungus belonging to the genus *Macrosporium* is the organism responsible for the disease in question.

Comparisons of this *Macrosporium* were made with *M. Solani* from potatoes; with *Macrosporium* cultures isolated from a tomato fruit rot from New Jersey, and with typical "nail-head" spots on tomatoes in Florida. These comparisons show that the *Macrosporium* here discussed differs from the one isolated in Florida, and resembles, on the other hand, *M. Solani* and the *Macrosporium* isolated in New Jersey. It should then be referred to in future as *Macrosporium Solani* Ell and Mart.

1193 – **Fungi Isolated from "Spotted" Apples in Great Britain.** — HORNE, A. S. (Dept. of Plant Physiology and Pathology, Imperial College of Science and Technnology), in the *Journal of Botany, British and Foreign*, Vol. LVIII, No. 694., pp. 238-242. London, Oct. 1920.

During an investigation into the spotting of apples, which commenced at Wisley in 1915, several fungi were isolated from the diseased tissue underlying the surface spots occuring on apples of many different varieties cultivated in Great Britain. These fungi do not usually form fertile reproductive bodies *in situ*; they sporulate, however, when grown in potato mush agar.

Besides *Leptospharia vagabunda, Coryneum foliicolum, Fusarium Mali, Alternaria Grossularieae,* and other readily identified species, the fungi obtained included a number of forms which could not be determined at the time. The latter are now regarded as new species, and technical descriptions are given for the first time using the following names:

Pleospora Pomorum, n. sp., *Polyopeus,* n. gen., *P. purpureus,* n. sp., (and vars. *verus, incoloratus, latirostratus, nigrirostratus*), and *P. Pomi,*

n. sp. (and var. *verus* and *torpidus*), *P. recurvatus*, n. sp., (and vars. *verus* and *curvatus*), *P. aureus*, n. sp., *Fuckelia botryoidea*, n. sp., *Coniothyrium Cydoniae* var. *Mali*, n. var., *C convolutum* n. sp., *Alternaria pomicola* n. sp. *Sclerotium stellatum* n. sp.

1194 – ***Sporotrichum Persicae* n. sp., a Mucedineae Injurious to the Peach in Liguria (Italy).** — POLLACCI G. in the *Atti dell'Istituto botanico dell'Università di Pavia*, Series II, Vol. XVII, Part 5, pp. 203-208, plate. 1 Milan, 1920.

In June, 1920, the Cryptogamic Laboratory at Pavia received from Albenga some peaches in different stages of development for examination. On the pericarps of all the fruits, there were white incrustations or patches; these were usually very clearly marked out, the edges being seldom irregular. Many of the peaches were covered with a numerous small spots, whereas on others the patches were few, but very extensive, sometimes invading the greater part of the pericarp. The colour of these incrustation was nearly always pure white, but in some cases there were blackish nuclei present.

From information received from Albenga, and from a visit paid there by the author, it appeared that this disease, which had never before been seen by the horticulturists of the district, was both serious and wide-spread. The author himself observed it on all the peaches he examined in the region of Loano.

The varieties most attacked were "Trionfo," "Amsden" and "Sneed."

The pericarp beneath the patch does not rot, but thin white incrustations form which spoil the fruit, and often render it unfit for sale. On cutting the peach, the tissue under the skin seems to be unaltered Among the innumerable hairs of the pericarp, and only where the patches are present, there appears, however, a quantity of hyphae, often accompanied by the conidia of a mucidinea described by the author as a species new to science, under the name of *Sporotrichum Persicae*, and which he considers to be the cause of the disease. The author suggest the name of "peach sporotrichosis" for the disease.

Artificial cultures of the micromycete were obtained by introducing portions of *Sporotrichum* taken from the characteristic patches of "sporotrichosis" into a medium composed of boiled peach pulp and agar. After two or three transplantations, pure cultures with the characters peculiar to the fungus are obtained. If a small piece of the fungus is removed with fine forceps from the patches of "sporotrichosis," or taken from the artificial cultures and placed on green peaches which are still growing on the tree, alterations of the pericarp very similar to these previously described make their appearance after a fortnight. Needle-inoculations gave no positive results.

Bordeaux mixture applied to the diseased peaches has had no good, practical effect. The author believes that it is necessary to treat the fruit with copper salts while they are still very young, and to use mixtures containing some adhesive substance, because, otherwise, the long hairs

covering the pericarp and forming a refuge for the mycete, prevent the drops of the spray from remaining on the peach.

Practical experiments carried out with a view to determining the effect of copper sulphate upon the germination of the conidia of *Spor. Persicae* taken from artificial cultures, have shown that very small quantities of a solution of copper sulphate are enough to kill the conidia, and thus prevent their germination.

1195 – **Disease and Pests of Pine-apple in Cuba.** — See No. 1119 of this *Review*.

WEEDS AND PARASITIC FLOWERING PLANTS

WEEDS AND PARASITIC FLOWERING PLANTS

1196 – **The Prickly Pear in Australia.** — ALEXANDRA, W. B. (Science Abstractor in *Institute of Science and Industry, Bulletin No.* 12, pp. 5-48 Melbourne, 1919; II. CAMPBELL W. S., *Queensland Agricultural Journal*, Vol. VIX, Pt. 2. pp. 73. Brisbane, Aug. 1920.

Although the tree pear has become naturalised in all Australian States, it is at present only in Queensland and New South Wales that prickly pears have become a pest. The area infested contracts with the areas under the principal crops 1916-17, as follows:

Crop	Area in Acres
Prickly Pear	**22 208 000**
Wheat	11 532 828
Hay	2 671 862
Oats	844 130
Green Forage	390 867
Maize	360 072
Orchards and Fruit Gardens	257 687
Total under Crops	**16 806 380**

The rapidity at which the prickly pear spreads can perhaps be sufficiently gauged by the fact that it has overspread some 23 000 000 acres in less than 50 years. There is little doubt that cattle and horses are more important agents in spreading the pear, than birds.

UTILISATION: *Food for Man.* — Reference is made only to use in other countries, of the Barbary Fig., *Opuntia Ficus-indica*, *O decumana*, and *O. streptacantha*.

Fodder for Cattle (1). — The Pest Pear (*Opuntia inermis*) has proved of considerable value as a fodder reserve in case of drought, but four experiments carried out with the feeding of this pear to steers, dairy cattle, calves, and sheep, point to the following conclusions: (1) Preliminary treatment is necessary prior to the feeding of stock. It may be harvested, sliced by hand or machine and fed in troughs, or singed, roasted or boiled. The last was found to be the least satisfactory. (2) This pear is not highly palatable to any of these animals, its chief utility is as an emergency drought feed. (3) For full maintenantce of stock, a

(2) See *R*, March 1915, No. 299; Nov. 1915, No. 1180, Feb. 1917, No. 169. (*Ed.*).

supplementary protein supplying feed is required, i. e. linseed meal, cocoa nut oil cake, maize oil meal, lucerne or cowpea (hay or chaff). (4) The inclusion of apreciable quantities of prickly pear in rations for milch cows lowers the percentage of butter fat, and reduces the total fat yield, but may slightly increase the flow of milk. The milk is suitable for cheese making purposes. For milch cows it is more advantageous to use only part and not the whole as ro: ghage ration. 5) *O. inermis* is a suitable feed for cows in calf if the deficiency of protein is added, also for weaned calves, during drought. (6) For dry sheep, the ration must also include some kind of rough chaff, and in any case is unsuitable for ewes rearing lambs, or for lambs. Blood-meal can be used instead of linseed or other meals to provide the necessary protein. (7) Cattle must have access also to edible scrub or herbage supplying protein. (8) In hot weather all stock fed with prickly pear require water.

Green Manure. — Potash is added to soil by this means (1) as well as its value as humus. In Ceylon, India, South Africa and Mediterranean Countries, and occasionally in Australia, it has been tried with success.

The products obtained from the prickly pear by the process of destructive distillation were investigated in 1913 (Cambpbell). The liquid distillate, crude tar and charcoal were constituted as follows ; Water, 88.4 %. — : cid (as acetic) 0.154 % — ammonia, primary and secondary amines (as ammonia) 0.005 % — tertiary amines (as pyridine) — crude Tar. 1 % — Charcoal 4 %.

As a source of alcohol and the utilisation of the fibre for conversion into paper pulp or board have not proved economical proceedings in Australia.

Eradication. — 1. *By Mechanical Means.* — The only adequate method suggested at present is the rolling down of the infested area, followed by collecting and burning or ploughing it in as green manure.

2. *Poisoning.* — The materials found more or less injurious to prickly pear were :— antimony chloride — arsenic mixtures — barium chlorate, — cadodylic acid — chlorine — chloroform — copper sulphate — ferrous sulphate — formaldehyde — lysol — mercuric chloride — mercuric oxycyanate — phenol — phosphorus — potassium compounds — sodium compounds — sulphuric acid — zinc chloride and zinc sulphate. Four methods were employed : Solid injection — liquid or solution injection, — spraying — gas or vapour charges.

The compounds of arsenic were found undo btedly the most efficacions and ecomical poisons, and during the last year of experiments only the three following specifics were given further trials viz : Arsenic acid (crude arsenic pentoxide) — arsenious chloride (arsenic trichloride) — arsenite of soda and salt (arsenic trioxide, caustic soda and common salt)

The first is the most poisonous specific, but is unobtainable in Australia ; arsenious chloride i: the only specific available where the pear is so dense that it can only be gassed ; arsenious acid " white arsenic " used in

(1) See *R.* Nov. 1915, No. 1131. (*Ed.*)

solution together with caustic soda is cheaper, but not so efficient. It is less dangerous to use but involves the use of large quantities of water and two spraying operations.

The cost under present circumstances amounts from £2.10s to £4 per acre.

3. *Employment of Natural Enemies* (1). — In many localities the Tree Pear (*Opuntia monacantha*) has been almost or quite exterminated by a cochineal insect (*Coccus indicus*, Green.). The author suggests that it is possible that a hybrid might be produced between the Pest Pear and the Tree Pear, and that the cochineal insect might be induced to feed on this, and after a time be transferred successfully to the other parent. A common snail (*Helix aspersa*) is adicted to prickly pears at Sydney and it is also suggested that a very large snail (*Achatina fulico*) from Africa should be introduced into infested areas.

The Travelling Commission of the Queensland Government prepared a list of number of other insects which live entirely on prickly pear in America, are not known to feed on any other type of vegetation, and which can be recommended to be introduced into Australia with proper safeguards, and also recommended that two fungi (*Gloeosporium lunatum* and *Sclerotium* or *Sclerotinia Opuntiarum*) which cause diseases of prickly pear in South America should also be introduced. The Government Advisory Council has received a grant for research work on the prickly pear problem. The author adds a list of the recommendations of the executive committee for this work, and also an appendix giving the sources of information and bibliography employed in this article, and the advised precautions which should be taken if arsenious chloride is used on infested areas.

II. — Apparently the only effective method of eradication in the infested area in New South Wales was found to be by burning, but in most cases this was inpracticable. The author considers that the only method which will keep the pear in check and ultimately eradicate it is the application if intense heat.

The heat formed by the combustion of 1.7 volumes of oxygen, and 1 volume of acetylene (3482° C) applied by specially constructed blowpipe, or even a heat of 1000° C would entirely melt the pear like wax. Although perhaps an expensive process, the results would prove exceptionally beneficial to Queensland.

1197 - **Efficiency of Indigenous Insect Pests as a Check on the Spread of *Lantana aculeata* (= *L. Camara*) Verbenaceae in India.** — Ramachandro Rao., in *Memoirs of the Department of Agriculture in India. Entomological Series*, Vol. V. No. 6. pp. 239-314, figs. 3, pl. 14. Calcutta, June 1920.

The author undertook the study of the indigenous insects parasitic on *Lantana aculeata* L. (= *L. Camara* L.), in India, with a view to ascertaining the existence of species which serve as an efficient check on the spread of this Verbenaceae, which was first introduced into the country as an ornamental plant, and has since become distributed at random

(1) See *R.* March, 1916, No. 365. (*Ed.*)

and is now a troublesome weed throughout India and Burma The shrub is really a denizen of the Tropical American Region and the distribution extends to Ceylon, Hong-Kong, Singapore, Mauritius, Seychelles, and in fact to the whole of Tropical Asia and Africa.

In Hawaii, successful results have been achieved by the introduction of Mexican insects by KOEBELE selected and set free by Dr. PERKINS; but conditions are unfavourable to importing foreign insects into India. A shipment of the seedfly (*Agromyza* sp.) was reported to have been made from Hawaii to New Caledonia, Fiji Isles, and Australia. But as the flora of India includes a number of other useful Verbenaceae spp., and seeing that the seed-fly is liable to attack these also, it is not considered prudent to introduce the said fly into India.

The author has discovered that in India and Burma, *L. aculeata* is subject to the attacks of numerous insects (he has enumerated 148 species), to two fungus diseases and to the attack of dodder (*Cuscuta* sp). Few of these are however really important

The most efficient undoubtedly is the Plume-moth (*Platyptilia pusillidactyla* Wlk.), Which is found throughout India, except perhaps in Punjab. It breeds also in *L. indica* and *Lippia germinata*; but is itself kept in check by parasites.

The various microlepidopterous caterpillars such as *Lobesia aeolopa* Meyr., *L. genialis* Meyr., *Cacoecia epicyrta* Meyr., are not found in sufficient numbers to prove efficient checks.

The Lymantriads, such as *Euproctis* spp. and *Olene mendosa* Hb. would be efficient, if they occurred in sufficient numbers, but as they also attack cultivated plants, they cannot be encouraged

The caterpillars of other lepidoptera *Hypena* sp., *Diacrisia obliqua* Wlk. var. *confusa* and *todara*, *D. flavens* Moore, *D. indica* Guer., *D. lubricipeda* (?), *Pericallia ricini* Fb., *Amsacta albistriga* Wlk., *Creatonotus gangis* L., *Celama internella* Wlk., *C. fasciata* Wlk., *Chionaema peregrina* Wlk., *Asura rubricosa* Moore are chiefly leaf-feeders and are not so useful as those that feed only on the flowers and thus directly control seed formation.

The dipteron *Asphondylia* sp., which feeds on the pollen masses and causes the formation of a gall, even when it occurs in abundance, is of low efficiency, and as it is very probably identical with *A. sesami* Felt., which is fairly serious on sesame in Coimbatore and Nagpur, it ought not to be introduced into new districts

Amongst the rhynchota, the bugs *Plautia* and *Nezara*, etc., are found feeding on fruits, whilst others attack flowers e. g. *Campylomma* sp., but it is doubtful if the bugs on the whole, are really efficacious. *Orthezia insignis* Doug., which has been unconsciously introduced into the Wynaad, is on the other hand an effective check on *Lantana*, as it is known to kill the bushes outright; but owing to its well known polyphagous nature, it is an insect which ought not to be tolerated.

The result of these investigations appears unmistakeably to indicate the absence at present of any indigenous insect capable of checking the

spread of *Lantana* in India. However, at least in parts of India, some insects are sufficiently numerous to serve as auxiliaries if an efficient insect of the nature of the *Agromyza* sp., were to be introduced.

1198 – **Eradication of Silver Fern in New Zealand.** — DEEM, J. W., in *The New Zealand Journal of Agriculture*, Vol. XX No. 6, pp. 358. Wellington, June, 21 1920.

From the experience of settlers, and according to the writer's own observations in North Island there appear to be only two effective methods of treatment where silver fern (*Pteris scaberula*) is prevalent. First, to subdivide the area and stock heavily with sheep or cattle, according to the conformation of the land. As the patches of fern are crushed out they should be surface sown with a heavy seeding of grass suitable to the district. If the land is steep, the mixture should contain a large percentage of *Danthonia pilosnia*. Secondly, to fire the patches of fern, preferably about the end of March, but this should not be undertaken unless the fern is in a very dry condition. As soon as the ashes are cool, a heavy seeding of grass is recommended and this to be sown before rain has fallen.

Pteris scaberula is also known as carpet fern, creeping fern, hard fern and pig fern.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERAL

1199 – **The Selection of Food Plants by Insects with Special Reference to Lepidopterous Larvae.** – BRUES, C. T. (Bussey Institute, Harvard University), in *The American Naturalist*, Vol. LIV No. 633, pp. 313-332. Lancaster, Pa. July-Aug. 1920.

Nearly all the larvae of the Lepidoptera are phytophagous at the present time and according to the author there can be no question that since the order has existed, this condition has prevailed. Owing to the change in the form of the trophi during metamorphosis by which the adults develop haustellate or sucking mouthparts, the food of the imagines is entirely different from that of the larvae, and they subsist on liquids, mainly the nectar of flowers.

Although nearly all the species feed on plant food, a few isolated cases feed on other living insects or on material of animal origin ; wool, horn, beeswax, etc. The prey in the second case almost always consists of Coccids or Aphids where predatory caterpillars are concerned. Other interesting examples are the *Feniseca tarquinius* which feed on plant lice on the alder and the *Lycaena arion*. The larva is herbivorous in its early stages, but enters the nest of ants to prey upon the anti-larvae during its final period of growth. No less than 75 species of European Lepidopterous caterpillars are known to be occasionally predatory through temporary aberrations of their trophic instincts. Such plasticity of behaviour leads to the conclusion that the origin of sarcophagy in Lepidoptera is due to independant changes which have become firmly fixed in individual species or genera.

The use of Phanerogams as food plants is very general, but it is noti-

ceable that in a former tabulation (SCUDDER) of the food plants of butterflies of eastern N. America, the following families are entirely omitted:— Iridaceae, Orchidaceae, Caryophyllaceae, Euphorbiaceae, Vitaceae, Primulaceae, and Rubiaceae. Observations as to the habits of special species seems, however, to indicate that the selection of food plants must be considered as dependent upon one or several of a number of factors namely:

1) The odour of the plant and also its taste; for example, the oligophanous species occuring on Cruciferae, Umbelliferae and various Compositae, and the selection by the same insect of several plants in a family like the Solanaceae where a more or less similar odour does not become a family characteristic.

2) Some attribute of the plant.

3) A similarity in the immediate environment or general form of the food plant. Certain oligophanous and polygaph a ous caterpillars feeding mainly on trees or shrubs, e. g., as the gipsy moth, *Cercropia* moth, etc. and some of the Arctiid moths that feed upon a great variety of low plants.

4) Apparently chance associations that have become fixed, which seem to be analogous to structural mutations.

The food habits are tabulated as follows:

Melitaeids	Various plants
Limenitids	» »
Apaturids	» »
Ruralids	» »
Urbicolids	» »
Papilionids	» » (Several groups with particular food plants)
Vanessids	Urticaceae, Compositae, etc.
Argynnids	Violaceae exclusively
Brenthids	Violaceae generally
Pierids	Cruciferae essentially
Anthocarids	» »
Satyrids	Graminae mainly
Sub Group Thymelicines	» »
Urbicolines	» »
Cyclopidines	» »
Hesperiines	Leguminosae and various other plants
Coliads	» almost entirely
Gonepterygids	Rhamnaceae
Lycaenids	Diverse food habits
Chrysophanids	Polygonaceae almost exclusively

1200 – ***Cycloneda sanguinea*, Carnivorous Insect in Cuba.** — See No. 1097 of this *Review*.

1201 – **Pests Attacking Rice in Southern Rhodesia.** — See No. 1093, of this *Review*.

1202 – **Insects Injurious to the Leguminous Forage Plant *Desmodium leiocarpum* in Cuba.** — See No. 1097 of this *Review*.

MEANS OF PREVENTION AND CONTROL, INSECTS ETC., INJURIOUS TO VARIOUS CROPS

1203 – **On *Bruchophagus funebris* Clover and Alfalfa Seed Chalcis Fly.** — URBAHNS, T. D. (Entomological Assistant, Cereal and Forage Insect Investigations), in the *United States Department of Agriculture, Bulletin* No. 812, pp. 1-19, tables 2, figs. 2, pl. 8, Bibliogr. of 11 publications. Washington, D. C., May 31, 1920.

Seed pods of alfalfa examined in California in April 1915 showed 39 % of the seeds to be infested. Periodical examination indicated that attacks increased until mid May, but from then until mid July the average dropt to 28 %, this being the time when pods were forming in great abundance. The average from then until the end of September was 49,5 %, and seed pods collected in mid October gave 85 % infected seed. After the harvesting of the latest seed crops, and after spring irrigation which hastens emergence of adults, there was a sudden scarcity of eggs, breeding larvae and pupae in the field.

Experiment proved that the pathenogenetic habit is well established in the females of this species.

The most practical methods of prevention are mostly cultural methods such as the burning over of infested areas to destroy hibernating larvae, and the cultivation of alfalfa seed fields during the winter, and thus covering the infested seeds containing these larvae. Irrigation in early spring is advised owing to the fact that the emergence of the pest is accelerated from seeds of the newly forming crop which would otherwise become sufficiently dry to force many of the larvae into a resting period. Actual destruction by irrigation has proved unpractical. Cutting early plants on waste areas ; the careful cutting of hay crops, pasturing before growing seed after the removal of the first crop, (but avoiding the mistake made by pasturing badly infested areas not worth harvesting) ; care taken to secure a heavy setting of pods with the first bloom and removing the crop from the field as early as possible : these are all essential in order to avoid a high percentage of infested seed.

As a result of the increased abundance of chalcis flies in the summer, an attempt to grow a second crop of alfalfa seed in a single season is destined to failure.

The larvae of a predacious midge described by FELT as a *Lestodiplosis* sp., apparently destroy the larva of *B. funebris*. It seems probable that they confine themselves to cracked and broken seeds and where the larva is exposed.

In addition to the hymenopterous parasites previously mentioned by the author (1), the following are included : 1) *Tetrastichus bruchophagi* Gahan in Northern United States, especially California. This has been observed to destroy about 50 % larvae 2) ; *T. venustus* Gahan found in California and. Arizona ; 3) *Liodontomerus insuetus* Gahan, New Mexico, Kansas, Arizona ; 4) *Habrocytus medicaginis* Gahan in California, Idaho, Utah, Arizona, South Dakota, Kansas, New Mexico, Nevada and Oregon 5) *Eupelmus* sp. in California.

(1) See *R.* June, 1919, No. 797. (*Ed.*)

The life history, distribution, and means of dispersion of *B. funebris* are described in detail.

1204 – ***Bruchus quadrimaculatus*, the Cowpea Weevil in Texas.** — PADDOCK, F. B. and REINHARD H. J., in *Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas, Bulletin* No. 256, pp. 92. figs. 3, pl. 6. College Station' Brazos County, Texas Dec. 1919.

Bruchus quadrimaculatus Fabr. (Cowpea weevil) seems to be found in every locality in Texas wherever any variety of *Vigna Catjang* is grown. The climatic conditions of the State are especially favourable for the development of the weevil. All varieties of cowpeas grow in the locality are subject to attack, and no preference is shown by the weevil to any particular variety. The annual loss in Texas of the *V. Catjang* crop, resulting from this insect, is very great.

Under favourable condition, the life cycle from egg deposition to emergence of the adult may be completed in less than 3 weeks. The weevil is very prolific. An average of 106 eggs have been produced by females during the warm season. Temperature has a positive influence on the rate of oviposition and the length of the various stages of the weevil. In stored seed, breeding is practically continuous throughout the year. Most weevils undoubtedly hibernate in stored seed. Nine generations of weevils occur in a year at the College Station.

The larva of *B. quadrimaculatus* is attacked by the parasite *Bruchobius laticeps* Ashmead. The minute egg parasite *Uscana semifumipennis* Girault destroys the weevil eggs in great numbers. The weevil is, however, not sufficiently checked by its natural enemies.

Proper harvesting will greatly reduce the initial infestation of the field. To prevent seed from becoming reinfested, it must be stored in tight bins or containers and not in sacks. The weevil can be destroyed in any stage by heating the infested seed to a temperature of 146°F for an exposure of 15 minutes which will not affect the germination of the seed. Fumigation with carbon bisulphide is an effective means of destroying the weevil, and used at the rate of 4 lb., per 1000 cub. ft., of space with a 24 hour exposure, it will kill the insect in any of its stages. It should be remembered that fumigated or heated seed is, contrary to the general belief, always subject to reinfestation by the weevil.

1205 – ***Rhyparida morosa* a Leaf Eating and Stem-Boring Beetle on Sugar Cane in Queensland.** — JARVIS. E. (Assistant State Entomologist) in the *Queensland Agricultural Journal*, Vol. XIII, Vol. 6, pp. 274-276, Pl. 1. Brisbane, June, 1920.

Report of the infestation of third "ratoons" (new shoots springing from the sugar-cane root after cropping) by the chrysomelid beetle in the Cairns district, Queensland, 1920.

The attacked leaves were edged with fragments of dead brown tissue lying between holes and thus cut off from the usual supply of moisture. Specimens were also noticed feeding with similar effects on the leaves of "blady grass" (*Imperata arundinacea*), the native food plant of this

insect. Experiments proved that three beetles in four days severely damaged a plant about 15 in., high.

The larva was found to have eaten a central tunnel about $^3/_4$ in. long at the base of the sucker, and it was also found in the succulent underground portions of the stalks of the "blady grass"; in all probability a certain percentage of young ratoon suckers growing close to the area covered with the former plant are often killed by this insect.

A description is given of the larva, pupa and the adult beetles. The last are noted to be somewhat gregarious in habit, and have often been found on the ends of young twigs of *Ficus opposita*.

1206 – **On *Prosayleus phytolymus* the Dicky Rice Weevil in Queensland.** — GALLARD, L., in *The Agricultural Gazette of New South Wales*, Vol. XXXI, Pt. 4, pp. 280-284. figs. 3. Sydney, April 3. 1920.

This has been a serious pest in orchards and nurseries for the last 15 years in Cumberland but no previous attempts had been successful in the discovery of the larvae of *Prosayleus phytolymus*. The writer, however, managed to secure both pupae and full fed larvae at various intervals in the year. The behaviour of these indicates that the pupae are not ready to emerge until the end of February, in conjunction with spring growth. The first brood takes place in October and November.

The insects live chiefly on young shoots and foliage, and young fruit is also attacked, but the question had remained unanswered as to why young trees eaten badly never made much growth. The reason can now be given owing to the discovery of larvae damaging the roots. Chafing on the bark and in many cases distinct corrugations along the roots could be traced. In this respect the habits of the larvae are almost identical with the apple root borer (*Leptops hopei*) although much smaller in appearance.

Preventive measures. — By shifting beds as the weevils appeared in any quantity an example is given of a fine plot of citrus trees almost free from any trace of attack. Where infected plots in other cases had been enclosed as poultry runs, the result was found advantageous. Reports with regard to the use of arsenate of lead sprays are contradictory but it is advised if used judiciously.

The discovery of a number of small carab beetles and Therevid fly larvae both very carnivorous, during the search for the larvae in question, suggests other possible modes of treatment and needs further investigation, especially as there has been a gradual decrease in trouble in the areas where these specimens were also found.

1207 – **Root-bark Channeller of Citrus *(Decilaus citriperda).*** — TRYON, H. (Entomologist), in the *Queensland Agricultural Journal*, Vol. XIII, Pt. 2, pp, 71-82, pl. 3. Brisbane, Feb. 1920.

The Director of Fruit culture A. H. BENSON, devised a field experiment to be conducted by J. MITCHELL in 1918 aiming at the subjugation of this pest, associating with him for the purpose a Montville Fruit Growers Experiment Plot Committee. In 1919 the author was sent to inquire into

the trouble, and gives details of the symptoms, the citrus species subject to the insect attack or immune, the factors contributory to attack, and a description of the insect and its habits with suggested remedies to combat the pest.

Results show that all varieties of citrus producing ordinary oranges, especially those of the mandarin type are favoured by the beetle. The lemon is also attacked in some instances (trees on non-lemon stocks, however, afforded the instances referred to). Not a single instance of a Seville orange tree showing injury was observed. Grafted or worked trees experienced the ill effects from attacks to a much greater extent than seedling trees. Deep rooting trees as ordinarily understood, escaped attack or injury ; shallow rooting ones the reverse. Trees that experienced most damage were those in which natural decadence had commenced or been accelerated in its progress by uncongenial soil conditions, defective treatment, soil depletion and adverse seasons, rendering the superficial soil unsuitable generally for plant growth.

Observations show that the floor and walls of the chamber at the head of the gnawed channel in which the grub resides produces constantly little droplets of gum that redden as they dry and fills its chambers not with the by-products of digestion, but with triturated fibre principally. In addition to the special gum exudation, on the sides of the channel and on its base to a less extent, issues from the active cambium and other elements of cortical tissue, a gelatinous substance that is of orange colour and hardens on exposure. This lining forms plant tissue also, and in fact is the commencement of the formation of callus, which will itself serve to protective living wood beneath from further destructive change. Circumstances do not always favour the development of this callus and then fatal injury may result.

With regard to preventives and remedies the author suggests the following : (1) As the insects evidently gain access to the roots at the base of the tree trunk or collar it would appear that they might be prevented by placing in the soil some repellant substance ; (2) at a later stage the new insect fumigant Para-chloro-benzine has been found to succed where others have failed ; (3) some fluid contact insecticide, not itself a plant tissue destroyer may be used, as the beetle is accessible in its " burrow " when the soil is dry, e. g. kyanit ; (4) judicious use of fertilisers, etc.

Further experiments are needed, however, as a guide to the best procedure, as a mode of treatment has not yet been discovered that can be relied upon for successful results.

1208 – ***Lyctus brunneus*, Powder post Beetle and its Parasite in Southern Queensland.** — FROGGATT, W. W. (Government Entomologist), in *The Agricultural Gazette of New South Wales*, Vol. XXXI, Pt. 4, pp. 273-276, Sydney. April 3, 1920.

Specimens of this beetle previous to their discovery in Australia, were elsewhere identified under the following synonyms :— *L. cobydiodes* (England), *L. glycyrrhizae* (France), and *L. rugulosus* (South Sea Islands).

It is certain that the eggs or young larvae are in the sapwood when the timber is sawn up and used for building purposes, but their presence is not evident until about 12 months after the house is erected. After a series of years the infected wood is reduced to a mass of wood dust, held together by an outer thin skin of wood perforated with fine holes. The larvae may be found in timber wherever unseasoned wood (or sapwood) has been worked up in both soft or hard woods.

Ther has been no previous record according to the writer, of a parasite attacking or checking the spread of this harmful beetle. But, in 1919, a badly infested punctured board of " blue fig " (*Elaeocarpus grandis*) from which powdered dust was falling, was kept under observation for several months. Several adult beetles then emerged in May, identified as *L. brunneus* and at the end of this month, their hymnoptera parasite, a Braconid wasp, 4 mm., long, was first noticed proceeding from the holes in the board.

A description is given of the insects belonging to the genus *Lyctus* as a whole and also of the appearance of the parasite.

Other members of thi genus elsewhere recorded as powder-post beetles are : *L. unipunctatus*, the most common and destructive, and *L. opaculus* in stems and canes of grape vines (in the United States), and *L. striatus* in red oak (*Quercus rubra*) floors (in Michigan).

1209 – **Damage Caused by White Ants Relative to the Temperature of the Subsoil in Bihar, India.** — See No. 1053 of this *Review*.

1210 – **Formosan Termites and Methods of Preventing Their Damage.** — Oshima Masamitsu (Institute of Science. Govt. of Formosa), in *The Philippine Journal of Science*, Vol. XV, No. 4, pp. 319-383, pl. 13. figs. 5, tables 43. Manila, Oct. 1919.

In Formosa and Japan 14 species of termites are found, four of which, namely, *Coptotermes formosanus*, *Leucotermes speratus*, *Leucotermes flaviceps* and *Odontotermes formosanus* are known as pests of wooden structures. During the last ten years, investigations were made by the author, especially with regard to the first mentioned species. After a thorough study of the habits of these termites, experiments were made with 45 species of native and exotic woods.

Comparative results from two experimental areas led to the conclusion that the teak ((*Tectona grandis* L.) and the cypress pine (*Callitris glauca*) are absolutely immune timbers.

Detailed records indicate that resistance is neither due to physical properties nor to the inorganic compounds contained in the timber. It is however due to the organic compounds (oils or alkaloids) repellent or distasteful to the termites, and these are extracted by means of benzene or alcohol. The cypress pine contains about 1 % of volatile constituents according to former investigations, but nothing definite can yet be stated concerning teak. The principal ingredient of the volatile constituent is guajol 60 % which is said to be highly antiseptic. The Foochow cedar (*Cunninghamia sinensis* R. Br.) the principal building material in South China contains " cedrol " 4.6 %, another sesquiterpene alcohol but not ident-

ical to guajol. This cedar is highly resistant but not immune. The Randai cedar (*Cunninghamia Konishii*) contains 1.62 % cedrol, but its resisting powers have not yet been investigated.

PREVENTIVE MEASURES. — As the sesquiterpene alcohol seemed to be one of the chemicals effective in preventing attack, work was extended to discover some home product from which this could be obtained, for use in conferring immunity upon non resistant timbers. Camphor oil was examined and analysis proved that this contained 25 % of the required alcohol. To test its effect, a fixed quantity was injected into Japanese pine It was found that the controls were seriously attacked after five to seven days while the treated blocks remained unattacked for about one year. After numerous experiments as to the result of treatment with different percentages of camphor green oil solution from the economical standpoint, the mixture of "Niizu" neutral oil and the camphor green oil (10% solution) was found the most advantageous.

The effectiveness of other chemicals was tested in combative measures against the termites *Odontotermes formosanus*. After three years trial, the only four chemicals which proved effective were the high fraction of coal tar, mainly consisting of anthracene oil distilled at temperature above 270°C, The percentage of damage was inversely proportional to the amount of the anthracene oil. The author recommends the use of this oil in the field but not for use in houses on account of the staining of timbers.

The termite proof concrete layer has been found entirely satisfactory in preventing the entrance of termites from the ground. Lime mortar is strictly forbidden as this is readily attacked.

[1210]

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The International Institute of Agriculture was established under the International Treaty of 7 June 1905, which was ratified by forty governments. Twenty-two other governments have since adhered to the Institute.

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PREFACE

This index though arranged alphabetically retains the grouping of the subjects used in the *International Review*.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the International Review.

The index consists of three parts: one of the original articles, one concerned with Agricultural Intelligence and the last with Plant Diseases.

In case of errors in the Bulletin with reference to scientific terms and the names of authors, it should be noted that the correct spelling can be relied upon in the Index.

The Table used for the conversion of the Weights, Measures and Money values of the various countries to the Metric System is included. A list is also given of the Periodical Publications reviewed by the Bureau.

This Index was prepared by redacteurs : Dr. Giulio Provenzal and Prof. Giulio Trinchieri, the latter compiled the Index of Plant Diseases. The whole was adapted to the English Edition by rédactrice Miss M. L. Yeo.

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IV. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	=	27.99961	inches
1 Ardeb (Egypt)	=	5.44435	bushels
1 Ardeb of wheat (Egypt)	=	2.95264	cwt.
1 Ardeb of hulled maize (Egypt)	=	2.75580	cwt.
1 Ardeb of barley (Egypt)	=	2.36211	cwt.
1 Ardeb of undecorticated rice (Egypt)	=	5.72812	cwt.
1 Ardeb of decorticated rice (Egypt)	=	3.83843	cwt.
1 Arpent (Canada)	=	0.84501	acres
1 Are [100 square metres]	=	107.63915	square feet
1 Arroba (Brazil)	=	33.06951	lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841	lbs.
1 Arroba (Mexico)	=	25.36687	lbs.
1 Bale of cotton (Brazil)	=	396.83415	lbs.
1 Bale of cotton (United States)	=	4.46431	cwt. (gross wt.)
1 » » » » »	=	4.26788	cwt (net wt.
1 Bale of cotton (India)	=	3.57145	cwt.
1 Barrel of wheat flour (Canada, United States)	=	1.75001	cwt.
1 Bar, see Millier			
1 Bow (Java, Dutch Indies)	=	76.36998	square feet
1 Bushel (United States)	=	0.96896	bushels
1 Bushel of oats (United States)	=	32	lbs.
1 Bushel of oats (Canada)	=	34	lbs.
1 Bushel of wheat and potatoes (United States)	=	60	lbs.
1 Bushel of barley (Canada, United States)	=	48	lbs.
1 Bushel of raw rice (United States)	=	45	lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	=	56	lbs.
1 Cadastral arpent (Hungary)	=	1.42201	acres
1 Cental (United States)	=	100	lbs.
1 Centiare [10 square metres]	=	10.76392	square feet
1 Centigramme	=	0.15432	grains
1 Centilitre	=	0.0022	gallons
1 Centimetre	=	0.393715	inches
1 Centistere	=	0.35315	cubic feet
1 Centner (Germany, Austria, Denmark)	=	110.23171	lbs.
1 Centner (Sweden)	=	93.71238	lbs.
1 Cho [60 ken] (Japan)	=	119.30327	yards
1 Cho (Japan)	=	2.45068	acres
1 Crown [100 heller] (Austria-Hungary)	=	10 *d*	at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	=	1s 1 1/8 *d*	at par
1 Cubic centimetre	=	0.06102	cubic inches
1 Cubic metre	=	1.30795	cubic yards
1 Decagramme [10 grammes]	=	0.35275	oz.

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	=	0.022 gallons
	=	0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 $^{33}/_{64}$ *d* at par
1 Dollar, gold, $ [100 cents] (United States)	=	4 *s* 1 $^{5}/_{16}$ *d* at par
1 Drachm, gold [100 lepta] (Greece)	=	9 $^{33}/_{64}$ *d* at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 *s* 7 $^{53}/_{64}$ *d* at par
1 Franc [100 centimes] (France)	=	9 $^{33}/_{64}$ *d* at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
1 Hectolitre [100 litres]	=	21.99755 gallons
	=	2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 $^{3}/_{200}$ farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 $^{33}/_{64}$ *d* at par
1 Leu [100 statinki] (Bulgaria)	=	9 $^{33}/_{64}$ *d* at par
1 Lira [100 centesimi] (Italy)	=	9 $^{33}/_{64}$ *d* at par
1 Litre	=	0.21998 gallons
	=	0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 $^{3}/_{4}$ *d* at par
1 Mark [100 penni] (Finland)	=	9 $^{33}/_{64}$ *d* at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres)	=	2 199.75539 gallons
	=	274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2s 2 61/66 d at par
1 Milreis, gold (Portugal)	=	4s 5 19/66 d at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Cape of good Hope)	=	2.11654 acres
1 Muid (Cape of good Hope)	=	24 gallons
	=	3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 33/66 d at par
1 Peso, gold [100 centavos] (Argentina)	=	3s 11 37/66 d at par
1 Peso, gold [100 centavos] (Chili)	=	1s 5 63/66 d at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1. 0. 6 43/66 at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18s 0 51/66 d at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2s 1 3/8 d at par
1 Rupee, silver [16 annas] (British India)	=	1s 4 d at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1s 11 51/66 d at par
1 Talari [20 piastres] (Egypt	=	4s 1 11/22 d at par
1 To (Japan)	=	0.49601 bushels
	=	3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2s 0 37/66 d at par
1 Zentner (Germany)	=	110.23171 lbs.

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